HOMELAND SECURITY
EMERGENCY MANAGEMENT

ENSURING SAFETY. PROTECTING COMMUNITIES.

State Multi-Hazard Mitigation Plan

Update 2018

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Administrative Handling Instructions

The following State Multi-Hazard Mitigation Plan is an **Unclassified** compilation of open source and publicly available information on the threats and hazards that have the potential to impact the State of New Hampshire, information relating to disasters and emergencies that the State has experienced, and a strategy for reducing or eliminating the long term risks posed by the threats and hazards. This document is authorized for public release.

For questions or additional information, please contact New Hampshire Homeland Security and Emergency Management at 603-271-2231 or by email at HSEMplanning@dos.nh.gov

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Certificate of Adoption

A Resolution Adopting the State Multi-Hazard Mitigation Plan Update 2018

WHEREAS, the State of New Hampshire has historically experienced damages from hazard events and continues to be vulnerable to natural, technological, and human-caused hazards which could potentially result in the loss of life, damage to property and the environment, economic hardship, and threats to public health and safety; and

WHEREAS, the State of New Hampshire has developed and received conditional approval from the Federal Emergency Management Agency (FEMA) for its Multi-Hazard Mitigation Plan Update 2018 under the requirements of 44 CFR 201.4; and

WHEREAS, meetings were held between February 2017 and May 2018, including the solicitation of public input, regarding the development and review of the Multi-Hazard Mitigation Plan Update 2018; and

WHEREAS, a Hazard Identification and Risk Assessment (HIRA), as well as a capability assessment, have been conducted to review the potential threats and hazards and their impacts to the State; and

WHEREAS, the Plan recommends several hazard mitigation actions/projects that will provide mitigation for hazards identified in the HIRA to protect people, property, and the environment from loss associated with those hazards; and

WHEREAS, adoption of this Plan will make the State of New Hampshire of eligible for funding to alleviate the impacts of future hazards;

NOW, THEREFORE, I, Christopher T. Sununu, GOVERNOR OF THE STATE OF NEW HAMPSHIRE, do hereby declare the adoption of the State Multi-Hazard Mitigation Plan Update 2018 as developed by the New Hampshire Department of Safety – Division of Homeland Security and Emergency Management.

IT IS HEREBY ORDERED the respective agencies and officials identified within this Plan are directed to pursue the actions assigned to them to protect lives, property, the environment, limit economic impact, and lessen the likelihood and/or impacts of the hazards identified within this plan. Future revisions and Plan maintenance required by and FEMA are hereby adopted as a part of this resolution for a period of five (5) years from the date of FEMA approval. An annual consultation between the State of New Hampshire and FEMA will occur in accordance with Federal Requirements.

ADOPTED and SIGNED this _____ day of _____ 2018

_____
Christopher T. Sununu, Governor
State of New Hampshire

_____
John J. Barthelmes, Commissioner
Department of Safety

_____
Perry E. Plummer, Director
Division of Homeland Security and
Emergency Management

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Record of Changes

Submit recommended changes to this document to HSEM via email: HSEMplanning@dos.nh.gov

Description of Change	FEMA Approval Date	Changes Completed by
Original Natural Hazards Mitigation Plan	October 1999	J. Shaunussey
Multi-Hazard Update per DMA 2000	October 22, 2004	M. Poirier / R. Verville
3 Year Update	October 19, 2007	M. Poirier / R. Verville
3 Year Update	November 1, 2010	M. Poirier / R. Verville / L. Harbour
3 Year Update	October 29, 2013	L. Cheney / B. Peck / P. Moore
5 Year Update (New FEMA Requirements)	[Date] 2018	W. Welch / V. Urango / K. Henderson

Record of Distribution/Availability

Plan Title	Distribution	Availability
1999 Natural Hazards Mitigation Plan	Hard Copies	Not on File
2004 Multi-Hazard Mitigation Plan	Hard Copies	On File at HSEM
2007 Multi-Hazard Mitigation Plan	Hard Copies	On File at HSEM
2010 State Multi-Hazard Mitigation Plan	Hard Copies / Online	On File at HSEM
2013 State Multi-Hazard Mitigation Plan	Hard Copies / Online	On File at HSEM
2018 State Hazard Mitigation Plan	Hard Copies / Online	Online / On File at HSEM

Acknowledgements

The State of New Hampshire Multi-Hazard Mitigation Plan Update 2018 was compiled by the State Hazard Mitigation Planning Committee (SHMPC) which was led by Whitney Welch, Vanesa Urango, and Kayla Henderson of the Department of Safety (DOS). Division of Homeland Security and Emergency Management (HSEM) Planning Section overseen by Fallon Reed and Cindy Richard (Planning Chief and Assistant Planning Chief, respectively).

Many federal, State, and local agencies participated in the development during the 2018 Plan update process in addition to other agencies such as the State's Regional Planning Commissions (RPCs). Information, guidance, and assistance provided by these various agencies greatly enhanced this document and contributed to meeting the requirements as set forth by law.

Special appreciation is also extended to all of those individuals who participated in this update by contributing valuable time and efforts. Your dedication and feedback made this all-hazards focused update more comprehensive and more useful to informing other State and local plans. Individuals who participated in the plan update process are listed within the Planning Methodology Section of this Plan.

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Executive Summary

In the United States, millions of dollars are spent each year on disaster response and recovery. By undertaking activities which reduce the impact of future disasters, known as *hazard mitigation*, local governments and the State can reduce the costs of New Hampshire's response and recovery costs as well as minimize the impacts of future disaster events.

The State of New Hampshire Multi-Hazard Mitigation Plan Update 2018 is an update to the State's 2013 Multi-Hazard Mitigation Plan. Since the last plan update, changes in legislation and FEMA Requirements have resulted in the need to revise and update the Hazard Mitigation Plan for the State. This Plan is an update of previous plans and follows the planning requirements as found in the FEMA State Hazard Mitigation Plan Review Guide[1] and pursuant to 44 CFR 201.4. Standard State Hazard Mitigation Plans must contain the following information:

- Description of the Planning Process
- Hazard Identification and Risk Assessment
- Mitigation Strategy
- State Mitigation Capabilities
- Local Coordination and Mitigation Capabilities
- Plan Review, Evaluation, and Implementation
- Adoption and Assurances
- Repetitive Loss Strategy

The purpose of this Plan is to reduce or eliminate the long-term risk to human life and property from the hazards identified within the Hazard Identification and Risk Assessment (HIRA) before, during, and after an incident or disaster. The Plan was developed by The New Hampshire Department of Safety (DOS) Division of Homeland Security and Emergency Management (HSEM) Planning Section with assistance from federal, other State, and local agencies, as well as input from Regional Planning Commissions (RPCs), private and non-governmental entities, as well as the public. New Hampshire HSEM is the lead agency for the hazard mitigation program in the State. The State's Hazard Mitigation Plan is the foundation and the key element for the State's comprehensive hazard mitigation program.

The State of New Hampshire has received 51 major disaster declarations, including Presidential Declarations (DR), Emergency Declarations (EM), and Fire Management Declarations (FM) since 1953 when New Hampshire's first disaster, DR-11 a forest fire, was declared.

[1] Federal Emergency Management State Mitigation Plan Review Guide effective March 2016 Link

The Plan contains four main overarching goals:

- Minimize loss and disruption of human life, property, the environment, and the economy due to natural, technological, and human-caused hazards through a coordinated and collaborative effort between federal, State, and local authorities to implement appropriate hazard mitigation measures.
- Enhance protection of the general population, citizens, and guests of the State of New Hampshire before, during, and after a hazard event through public education about disaster preparedness and resilience, and expanded awareness of the threats and hazards which face the State.
- Promote continued comprehensive hazard mitigation planning at the State and local levels to identify, introduce, and implement cost effective hazard mitigation measures.
- Address the challenges posed by climate change as they pertain to increasing the risk and impacts of the hazards identified within this plan.

Following an all-hazards planning perspective, this Plan takes into account Natural, Technological, and Human-caused Hazards. After careful review of the hazards listed in the 2013 State Multi-Hazard Mitigation Plan, one hazard was removed (radon) due to lack of updated information, and 10 hazards were added to the plan for total consideration of 25 hazards across the three hazard types. Specifically, the plan addresses the following hazards:

2018 SHMP Identified Hazards		
Natural Hazards	Technological Hazards	Human-caused Hazards
• Avalanches • Coastal Flooding • Inland Flooding • Drought • Earthquakes • Extreme Temperatures • High Wind Events • Infectious Diseases • Landslides • Lightning • Severe Winter Weather • Solar Storms and Space Weather • Tropical and Post-Tropical Cyclones • Wildfires	• Aging Infrastructure • Conflagration • Dam Failure • Hazardous Materials • Known and Emerging Contaminates • Long Term Utility Outage • Radiological	• Cyber Event • Mass Casualty Incident • Terrorism/Violence • Transport Accident

Introduction

The State Multi-Hazard Mitigation Plan (SHMP) was developed by the New Hampshire Department of Safety (DOS), Division of Homeland Security and Emergency Management (HSEM) to establish a comprehensive, long-term plan to reduce the loss of life and property, as well as damage to the environment by identifying risks and vulnerabilities associated with hazards and developing long-term strategies (including actions and projects) which reduce the likelihood and/or impacts of the hazards identified to affect the State of New Hampshire. Mitigation plans are the key to breaking the cycle of disaster damage, reconstruction, and repeated damage. Developing a hazard mitigation plan allows for the following:

- Increased education and awareness around threats, hazards, and vulnerabilities;
- Building partnerships for risk reduction which include government, organizations, businesses, and the public;
- Identify long-term, broadly supported strategies for risk reduction;
- Align mitigation efforts with the local communities;
- Identify implementation approaches that focus resources on the greatest risks and vulnerabilities; and,
- Communicate priorities to potential sources of funding.

A FEMA-approved hazard mitigation plan is a condition for receiving certain types of non-emergency disaster assistance including funding for mitigation projects. A FEMA-Approved State Plan is a requirement for the following FEMA programs:

- Public Assistance (Categories C-G)
- Fire Management Assistance Grants (FMAG)
- Hazard Mitigation Grant Program (HMGP)
- Pre-Disaster Mitigation (PDM)
- Flood Mitigation Assistance (FMA)

What are Threats and Hazards?

Threats and hazards are sources of negative risk. Traditionally, natural risks tend to be classified as hazards, while technological and human-caused risks tend to be classified as threats. For the purposes of this plan, threats and hazards will be considered together, regardless of their classification. A hazard is a source of risk in a harmless state (such as a river) and the threat is an event or condition with the potential to cause fatalities, injuries, property damage, infrastructure damage, agricultural loss, environmental damage, business interruption, or other losses (such as when the river floods). Hazards are classified as follows:

- **Natural Hazard** - These events are emergencies caused by forces extraneous to man in elements of the natural environment. (e.g., earthquake, flood, hazardous weather, public health emergency).
- **Technological Hazard** - These incidents involve materials created by man and that pose a unique hazard to the general public and environment. The jurisdiction needs to consider incidents that are caused by accident (e.g., mechanical failure, human mistake), result from an emergency caused by another hazard, or are caused intentionally. (e.g., infrastructure/utility disruption, radiological, or hazardous material release).
- **Human-Caused Hazard** - These are disasters created by man, either intentionally or by accident. (e.g., criminal or violent behavior, intruder, civil unrest, active shooter, terrorism).

What is Hazard Mitigation?

In order to better understand the SHMP, it is important to understand what hazard mitigation is. Hazard mitigation is defined as the effort to reduce loss of life and property by lessening the impacts of disasters. This involves actions or projects which reduce or eliminate long-term risk to hazards. Hazard mitigation aims to make communities safer and more resilient. Examples of hazard mitigation actions and projects include, but are not limited to:

- Acquisition or relocation of flood prone properties
- Erosion control
- Flood risk reduction
- Generators
- Hazard mitigation planning
- Structural retrofitting
- Wildfire mitigation

Background and Authority

The State Multi-Hazard Mitigation Plan Update 2018 builds upon the previous versions of New Hampshire's Mitigation Plans dating back to 1999. The first State mitigation plan was written as a result of a hazards assessment following the July 1998 disaster declaration, DR-1231 (a flood event). This assessment, which was conducted by NH HSEM (then the Office of Emergency Management) and the Federal Emergency Management Agency (FEMA) Region I Mitigation Staff, determined that there was not a viable plan in place that would satisfy the requirements of Section 409 of the Robert T. Stafford Disaster Relief Act (Stafford Act). At the time, Section 409 required that states maintain and update a mitigation plan following a major presidentially declared disaster. Therefore, the initial edition of this plan was developed and presented to FEMA on April 1, 1999 and approved in October of 1999.

The Disaster Mitigation Act of 2000 (including 44 CFR §201 and §206) eliminated the plan update requirement following Presidential Declared Disasters. In November 2004, the DMA of 2000 required that states review, update, and receive formal approval from FEMA on the plan every 3 years. Effective May 27, 2014, 44 CFR §201 was amended which reduces the frequency of State Mitigation Updates by extending the update requirements from 3 to 5 years. Section 322 of the Stafford Act provides additional information and requirements related to Hazard Mitigation Plan requirements. The aforementioned CFRs provide specific requirements as to the content of the hazard mitigation plan, which states must completely meet in order to obtain FEMA approval. There are two levels of State plans; enhanced and standard. The State of New Hampshire has developed a Standard State Mitigation Plan. In March 2015, the State Mitigation Plan Review guide, the official policy on an interpretation of the mitigation planning requirements, provided new guidance and was disseminated effective March 2016. This 2018 Plan update follows the new and updated State Mitigation Plan Review Guide and respective requirements.

Authority for the development of this Plan by New Hampshire Homeland Security and Emergency Management (NH HSEM) is contained in the New Hampshire Revised Statutes Annotated (RSA), Chapter 21-P Section 21-P: 37.

It is HSEM's goal to have all incorporated communities within the State obtain and maintain a FEMA-approved local hazard mitigation plan as a means to reduce future losses from hazard events. State and local hazard mitigation planning guidance references requirements for only natural hazards to be assessed; however, HSEM recognizes the importance of incorporating all-hazards into this document so

that it may work in cooperation with the State Emergency Operations Plan (SEOP), the State Recovery Annex, as well as other State, county, and local emergency plans.

Purpose

The purpose of this Plan is to provide an overview of the natural, technological, and human-caused hazards that impact the State and outline the State's Plan for the mitigation of damages that may be associated with these events. This Plan will reveal in detail how the State will address planning for future natural, technological, and human-caused hazards and to reduce the impact of those hazards.

The Plan identifies, analyzes and assesses the risk of the hazards that affect the State of New Hampshire. Therefore, the Plan has been incorporated as an annex to the State of New Hampshire Emergency Operations Plan (SEOP) and will continue to be an annex with each update.

Scope and Jurisdiction

This 2018 updated plan addresses the entire State of New Hampshire. The concept of a State Hazard Mitigation Plan is undeniably broad. This plan will address the entire State by first reviewing threats and hazard risk at the State level and then identifying which counties are most vulnerable to the hazards (for example, while the State may be impacted by coastal flooding, only coastal communities would experience this hazard; conversely, some of the more mountainous regions of the State may experience avalanches, whereas the flatter coastal communities would not be susceptible to avalanches.)

Assurances

The State of New Hampshire, Department of Safety, Division of Homeland Security and Emergency Management assures that the State will comply with all applicable Federal Statutes and regulations at all times during which it receives grant funding. Pursuant to 44 CFR §13.11(c), HSEM will amend this plan whenever necessary to reflect changes in State of Federal Laws and Statues. HSEM will also ensure the provisions of 2 CFR §200 and its subsections are appropriately followed. The State Hazard Mitigation Officer (SHMO) will be responsible for ensuring grant compliance with FEMA and leading the review and update of the State Hazard Mitigation Plan.

In August 2015 a 20 foot wide by 25 foot deep sinkhole appeared in Concord on Interstate 93 North between Exits 13 and 14. The cause was due to a culvert that dated back to the 1950s letting go due to its age and significant rain received the night before the collapse. *(Source– NH DOT)*

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Plan Goals and Objectives

The overall purpose of this Plan is to reduce the loss of life and property by lessening the probability and impact of disaster events. The goals contained within the State of New Hampshire Multi-Hazard Mitigation Plan Update 2013 were reviewed and revised to better reflect the threats and hazards identified within the 2018 Plan update, incorporate progress in mitigation over the past five years, to be in harmony with the goals of local hazard mitigation plans, and to follow an all-hazards planning perspective which incorporates technological and human caused hazards in addition to natural hazards.

Overarching Goals

The following are the five overarching goals of this Plan:

- Minimize loss and disruption of human life, property, the environment, and the economy due to natural, technological, and human-caused hazards through a coordinated and collaborative effort between federal, State, and local authorities to implement appropriate hazard mitigation measures.
- Enhance protection of the general population, citizens, and guests of the State of New Hampshire before, during, and after a hazard event through public education about disaster preparedness and resilience, and expanded awareness of the threats and hazards which face the State.
- Promote continued comprehensive hazard mitigation planning at the State and local levels to identify, introduce, and implement cost effective hazard mitigation measures.
- Address the challenges posed by climate change as they pertain to increasing the risk and impacts of the hazards identified within this plan.
- Strengthen Continuity of Operations and Continuity of Government across the State and local levels to ensure continuation of essential services.

Natural Hazard Objectives

- Reduce long-term flood risks through assessment, identification, and strategic mitigation of at risk/vulnerable infrastructure (dams, stream crossings, roadways, coastal levees, etc.)
- Minimize illnesses and deaths related to events that present a threat to human and animal health
- Assist communities with plan development, outreach, and public education in order to reduce the impact from natural disasters
- Ensure mitigation strategies consider the protection and resiliency of natural, historical, and cultural resources.

Technological Hazard Objectives

- To ensure technological hazards are responded to appropriately and to mitigate the effect on citizens.
- Build upon State capabilities to identify and respond to emerging contaminates
- To effectively collaborate between federal, State, and local agencies as well as private partners, NGOs, and VOADs
- Enhance public education of technological hazards to assist in the prevention and mitigation of hazard impacts on the population
- Ensure HAZMAT teams are properly equipped and trained to respond, contain, and mitigate incidents involving technological hazards

- Reduce the possibility of long-term utility outages by planning, training, and exercising on utility failure events
- Lessen the effects of technological hazards on communications infrastructure by building more resilient voice and data systems

Human-caused Hazard Objectives

- Ensure that grant related funding processes allow for expedient and effective actions to take place at the community and State-level
- Identify Critical Infrastructure and Key Resources (CIKR) risks or vulnerabilities and protect or harden State infrastructure against hazards
- Improve the ability to respond and mitigate Cyber Events through increased training, exercising, improved equipment, and utilizing the latest technologies
- Foster collaboration between federal, State, and local agencies on training, exercising, and preparing for mass casualty incidents and terrorism
- Ensure State assets (i.e. Hospitals, State agencies, non-profits, universities, etc.) are prepared for all phases of emergency management including training and exercising on reunification

Planning Methodology

Basic Methodology

FEMA's 2013 Local Mitigation Planning Handbook sets forth a nine task planning process to be undertaken to update a Local Hazard Mitigation Plan. The State Hazard Mitigation Plan update generally follows these same nine tasks:

1) Determine the Planning Area and Resources
2) Build the Planning Team
3) Create an Outreach Strategy
4) Review [State] Capabilities
5) Conduct a Risk Assessment
6) Develop a Mitigation Strategy
7) Keep the Plan Current
8) Review and Adopt the Plan
9) Create a Safe and Resilient [State]

Several of the tasks were accomplished independently while other tasks were completed sequentially. While the 2018 update of the SHMP was a complete overhaul and revision to meet the updated FEMA requirements for states, much of the historical information came from the 2013 Plan and associated previous editions of the State Multi-Hazard Mitigation Plan.

During the planning process, careful consideration was given to the 2015 State Hazard Mitigation Plan Review Tool to ensure the plan and planning process met the State specific requirements. Reference to FEMA's Comprehensive Guides 101 and 201 were given in addition to ensuring plan alignment across all related plans (SEOP, COOP, Recovery Annex, etc.).

Meeting Schedule and Activities

Meeting	Date	Activities
Initial	2/1/17	The HSEM Internal SHMP Working Group met to plan timeframe, logistics, and begin SHMP update.
Kickoff Meeting (1)	4/7/17	Hosted kick-off meeting at NHDES with over 30 participants, reviewed planning process, determined hazards, and developed plan goals.
Strategy	2/7/18	The HSEM Internal SHMP Working Group met to update timeline, discuss next steps, and plan meetings with stakeholders.
Strategy & HIRA	2/23/18	The HSEM Internal SHMP Working Group continued the development of the HIRA and discussed the logistics for the upcoming stakeholder meetings in April.
Probability Table and HIRA Review	3/5/18	The HSEM Internal Working Group met to generated probability ratings for the natural hazards section within the HIRA.
Review of Mitigation Capabilities	3/16/18	The HSEM Internal Working Group met to review the 2013 mitigation capability assessment.
Capability Assessment	3/22/18	The HSEM Internal SHMP Working Group met to prepare and build out the Capability Assessment worksheet for the April stakeholder meeting.

Meeting	Date	Activities
FEMA	3/26/18	The HSEM Internal SHMP Working Group met with FEMA Region I Planner, Jay Neiderbach, to further review State Multi-Hazard Mitigation Plan requirements.
HIRA Continued	3/28/18	The HSEM Internal SHMP Working Group continued development of the HIRA incorporating stakeholder feedback as provided.
Stakeholder Meeting (2)	4/6/18	Hosted second stakeholder meeting to review the 2013 Capability Assessment, identify gaps and/or problem statements, and brainstorm "new" capabilities for the 2018 Plan.
Capability Assessment	4/13/18	The HSEM Internal SHMP Working Group worked on the incorporation of data and information from the April stakeholder meeting.
HIRA, Capability Assessment, and Probability Table	4/23/18	The HSEM Internal SHMP Working Group met to build out the Probability Table with historical occurrence information provided within the HIRA. The Final Draft of the Capabilities Assessment was reviewed.
Mitigation Actions	5/11/18	The HSEM Internal SHMP Working Group met to prepare the 2013 Mitigation Actions list for status review at the May stakeholders meeting.
Stakeholder Meeting (3)	5/18/18	Hosted third stakeholder meeting to review current status of the 2013 Mitigation Actions, discuss gaps, and identify "new" actions for the 2018 Plan.
Final Draft Compilation	6/4/18	The HSEM SHMP Internal Working Group met to compile the elements of the final draft for stakeholder review.
Final Draft Open for Public Review	6/20/18	A final draft was posted to the NH HSEM Resource Center webpage for public comment and review.
Final Draft Submission	6/29/18	Plan was submitted to FEMA for initial review.

State Multi-Hazard Mitigation Planning Committee

Name	Title	Agency
Fallon Reed	**Planning Chief**	**HSEM**
Cindy Richard	**Asst. Planning Chief**	**HSEM**
Whitney Welch	**State Hazard Mitigation Officer (SHMO)**	**HSEM**
Vanesa Urango	**All Hazards Planner**	**HSEM**
Kayla Henderson	**Hazard Mitigation Planner**	**HSEM**
Roger Appleton	Engineer	DOT
Lucio Barinelli	Lab Manager	DHHS
Lee Baronas	Assistant Traffic Engineer	DOT
Laura Bartlett	REP Program Planner	HSEM
Diane Becker	EMAP Contractor (fmr. Chief of Technological Hazards)	HSEM
Deirdre Boulter	Supervisory Intelligence Analyst	IAC
Julia Chase	Assistant Chief of Field Services	HSEM
Leigh Cheney	Director, Emergency Services Unit	DHHS
James Chithalen	Toxicologist	DHHS
Bob Christensen	Chief of Operations	HSEM
Maureen Collopy	Microbiologist IV	DHHS
Shane Csiki	Flood Hazards Admin/Fluvial Geomorphologist	DES
Elizabeth Daly	Chief, Bureau of Infectious Disease Control	DPHS
Amy Dixon	Grants Manager	DNCR
Steve Doyon	Administrator	DES
Heather Dunkerley	Senior Field Representative (fmr. SHMO)	HSEM
Tim Drew	Public Information and Permit Admin	DES
Joe Ebert	Lieutenant Director, Info. and Analysis Unit	NHSP
Samara Ebinger	Principal Planner	OSI
Edna Feighner	Archaeologist	DHR
Jim Gallagher	Environmental Engineer	DES
Jennifer Gilbert	Senior Planner/Floodplain Management Coordinator	OSI
Sherry Godlewski	Resilience and Adaptation Manager	DES
Paul Hatch	Field Representative	HSEM
Kirsten Howard	Coastal Resilience Specialist	DES
Steve Johnson	Senior Engineer	DOT
Mark Kirouac	Senior Engineer	DOT
Alex Marinaccio	Field Representative	HSEM
Johnna Mckenna	Supervisor Drinking Water	DES
Parker Moore	Community Planner (fmr. HSEM E.M. Planning Specialist)	FEMA
Nathalie Morison	Coastal Resilience Specialist	DES
Danielle Morse	Assistant Chief of Operations	HSEM
Mark Mudge	Planning Analyst	IAC
Jay Neiderbach	Community Planner	FEMA
Bryan Nowell	Forest Ranger Captain	DNCR
Kashena Perkins	Program Specialist	DHHS
Bill Ray	Managing Director, Policy, Planning & Communications	NH Housing
Thomas Riley	District Chief	FMO
Kim Roberts	REP Planner (fmr. Field Representative)	HSEM
Steve Sherman	Chief, Forest Protection Bureau	DNCR
Rick Skarinka	Civil Engineer VI	DES
Mike Todd	Public Information Officer	HSEM
Carole Totzkay	Program Planner III	DHHS

Name	Title	Agency
David Trubey	Archaeologist, Review and Compliance Coordinator	DNCR
Neil Twitchell	Administrator	DPHS
Vaillancourt, Dave	Chief of Field Services	HSEM
Way, Christopher	Administrator	DNCR
Bill Wood	Preparedness Coordinator	FSTEMS
John Wynne	Communications Chief	HSEM

This Plan was also prepared with the assistance of other NH Homeland Security and Emergency Management staff members.

Narrative Description of the Process

February 1, 2017 – Initial HSEM Meeting

The planning process for the 2018 update of the SHMP began in February 2017 with an initial planning meeting with Fallon Reed (Planning Chief), Heather Dunkerley (Senior Field Representative), Whitney Welch (State Hazard Mitigation Officer), and Parker Moore (fmr. Emergency Management Planning Specialist) at HSEM in Concord, New Hampshire. At this meeting, a timeframe for the update was created, the previous list of state hazard mitigation plan committee members was reviewed and a new list of potential members was generated, a public and private outreach strategy was discussed, and a kick-off meeting scheduled for April 7, 2017. In between meetings, HSEM staff worked on logistics for future meetings, information gathering, and preparing the 2018 plan.

April 7, 2017 – Kickoff Meeting

After being delayed due to severe winter weather, the kickoff meeting for the 2018 Update of the State Hazard Mitigation Plan was held at NHDES with the full State Hazard Mitigation Plan Update Committee. After participant and facilitator introductions were completed, the purpose of the State Hazard Mitigation Plan and update process were reviewed. The Hazard Identification and Risk Assessment (HIRA) process was reviewed and committee deliberated on the threats and hazards to be included in this year's update. With the threats and hazards identified, the committee then determined the goals for the Plan update process. At the conclusion of the meeting, Parker identified expectations for moving forward with the update to include outreach methodologies, future meetings, and how HSEM was going to draft the information gathered at this meeting, compile the information appropriately, and provide it for committee review via e-mail.

February 7th, 2018 – HSEM Strategy Meeting

The HSEM All Hazards Planner (Vanesa Urango) and Hazard Mitigation Planner (Kayla Henderson) met with the SHMO (Whitney Welch) after her return from maternity leave to form the HSEM Internal SHMP Working Group and discuss an action plan for remaining steps in the SHMP update process. The current state of the Plan was discussed and next steps were formulated to ensure the timely completion of the HIRA. Meetings were planned for stakeholders to hand out the completed HIRA, develop problem statements, and discuss existing capabilities that were identified in the 2013 SHMP. Additionally, a meeting was scheduled to review the mitigation action strategy from the 2013 SHMP, determine the current status of each action and provide updates.

February 23, 2018—HSEM Strategy and HIRA Development Meeting

The HSEM SHMP Internal Working Group met to review the portion of the Plan that was completed by Parker Moore (fmr. HSEM E.M. Planning Specialist) and continue building out the elements of the natural hazards portion of the HIRA. They also made a plan for the development of the technological

and human-caused hazards and identified key stakeholders that would need to be contacted to provide subject matter expertise to the remaining sections of the HIRA. Lastly, they began discussing the logistics for the stakeholder meetings that would be needed for the mitigation capabilities and strategy reviews.

March 5, 2018—HSEM Review of Probability Table and HIRA Review Meeting

The HSEM SHMP Internal Working Group met to review the probability ratings from the 2013 Plan and update the table to accommodate the new hazards in the 2018 Plan update. The group generated probability ratings for the table for the natural hazards. Lastly, the natural hazards sections within the HIRA went through additional group edits.

March 16 & 22, 2018—HSEM Review of Mitigation Capabilities

The HSEM SHMP Internal Working Group met to review the mitigation capabilities presented in the 2013 Plan. The SHMO created a table on the previous capabilities that would be used to undergo stakeholder review and gather input on capabilities that have been developed in the last five years. Logistics were discussed for an April stakeholder meeting.

March 26, 2018—HSEM Meeting with FEMA

The HSEM SHMP Internal Working Group met with Jay Neiderbach from FEMA Region I to discuss interpretation and review process for standard plan requirements.

March 28, 2018—HSEM Development of HIRA Elements

The HSEM SHMP Internal Working Group met to continue development of the HIRA. Feedback from stakeholders was applied to applicable hazards.

April 6th, 2018—2018 SHMP Stakeholder Meeting

A stakeholder meeting was held at the NH DOT building in Concord to discuss mitigation capabilities. The meeting included stakeholders from many sectors, including Jay Neiderbach from FEMA, that were chosen to provide subject matter expertise for natural, technological, and human-caused hazards. The meeting was productive and gathered a vast amount of feedback on the mitigation capabilities that were presented in the 2013 plan. Additionally, the facilitators (the HSEM Internal SHMP Working Group) led the discussion to ensure that mitigation capabilities that have been developed between 2013 and the 2018 were captured for the 2018 Plan update. The HSEM Internal SHMP Working Group wrapped up the meeting by giving information on the current progress and timeline of the Plan and discussed how their input would be incorporated into the Plan update. The meeting closed with the announcement of the next stakeholder meeting that would likely take place in May to update the mitigation strategy for the 2018 Plan.

April 13, 2018—HSEM Strategy and Plan Development Meeting

The HSEM SHMP Internal Working Group met to incorporate data and information obtained from the April 6th stakeholder meeting.

April 23, 2018—HSEM Strategy and Plan Development Meeting

The HSEM SHMP Internal Working Group met and continued to build the probability table and review the final capabilities assessment table.

May 11, 2018—HSEM Stakeholder Event Preparation Meeting

The HSEM Hazard Mitigation Planner (Kayla Henderson) met with the SHMO (Whitney Welch) to review 2013 Plan actions and determine their status (ongoing, completed, deleted, or deferred) based upon existing knowledge prior to the May 18th stakeholder meeting.

May 18, 2018—HSEM Stakeholder Event Preparation Meeting

The SHMPC met at the final stakeholders meeting to identify the current status of the 2013 mitigation actions and identify new actions for the 2018 update. Prior to closing the meeting, the SHMO notified the SHMPC that they would be receiving a prioritization worksheet via email to rank the 2018 mitigation actions.

June 4, 2018—HSEM Stakeholder Event Preparation Meeting

The HSEM SHMP Internal Working Group met to compile the elements of the final draft for stakeholder review.

June 20, 2018—Public Comment Period

A final draft was posted to the NH HSEM Resource Center webpage for public comment and review. Upon posting, NH HSEM sent out a notice via social media platforms.

June 29, 2018—Plan Submitted to FEMA

Plan was submitted to FEMA for initial review.

Federal Agency Coordination

Throughout the SHMP update process, HSEM coordinated and shared information with the Federal Emergency Management Agency (FEMA) Region I Office Risk Analysis Branch and Hazard Mitigation Branches. The Risk Analysis Branch provided information, guidance, resources, and suggestions on the development, review, and approval of the SHMP. The Hazard Mitigation Branch provided information, guidance, and resources related to the Hazard Mitigation Assistance Grants which HSEM administers. Representatives of Region I were consulted and provided an opportunity to serve on New Hampshire's SHMP update committee.

Both of these branches are also involved in New Hampshire's Program Administration by State (PAS) status through which New Hampshire was appointed the authority in 2016 to approve local hazard mitigation plans.

State Agency Coordination

As the lead State agency for updating the SHMP, HSEM coordinated the mitigation planning process, developed the mitigation planning committee, and authored the Plan update. HSEM coordinated with numerous other State agencies with expertise in mitigation or mitigation related activities. Members of the following State agencies were invited to participate on the Committee:

- Transportation
- Health and Human Services
- Public Health Services
- Environmental Services
- Homeland Security and Emergency Management
- Information and Analysis Center
- Business and Economic Affairs
- Resources and Economic Development
- Office of Strategic Initiatives
- New Hampshire Housing
- Fire Standards and Training and Emergency Medical Services
- Fire Marshal's Office
- Federal Emergency Management Agency
- Information Technology
- Cyber Integration Center

Participation

Opportunities for statewide partners, stakeholders, and the general public to provide input, review, and comment on the plan was provided throughout the planning process. Involvement was solicited and publicized through the following methods:

- NH HSEM Twitter (About 4,600 followers)
- NH HSEM Facebook account (About 7,100 'likes')
- NH HSEM website and resource center
- In person meetings
- Via email

Private Entity, NGO, Academic, Business and Industry, and Other Sector Participation

In addition to utilizing the same methodology to notify private entities, Non-Governmental Organizations (NGOs), academia, business and industry, and other sectors for participation and input related to the update of this Plan, HSEM utilized its listservs to email information to these partners. HSEM has two main listservs:

- Emergency Support Function Listserv: About 390 e-mail addresses
- WebEOC Listserv: 2,135 e-mail addresses
- Emergency Management Director Listservs: About 30 listservs in total with 750 e-mail addresses

Plan and Program Integration

While this Plan provides an opportunity for agencies and organizations to collaborate on issues of hazard mitigation; coordination among agencies on planning and other initiatives across all mission areas is constant. Planning and programmatic efforts that could integrate information from this Plan or provide information to be integrated into this Plan are as follows:

State Emergency Operations Plan (SEOP)

While this Plan is included as a supporting annex to the SEOP, the information contained within the HIRA of this plan plays an important role in the SEOP. The SEOP identifies roles, responsibilities, and actions of the State during incidents, emergencies, and disasters. The SEOP addresses the ability to direct, control, coordinate, and manage emergency operations and follows the Emergency Support Function (ESF) format.

State Recovery Annex

The State Recovery Annex is another supporting annex to the SEOP which details the roles, responsibilities, and actions of the State and its partners to recover from an incident, emergency, or disaster. The Recovery Annex follows the guidelines set forth in the National Disaster Recovery Framework (NDRF) and recovery responsibilities are divided into 6 different Recovery Support Functions (RSFs). As the recovery process extends into the later phases, hazard mitigation becomes a central element in the recovery process to ensure that communities continue to build resiliency, lessen the likelihood of hazards, and lessen the impacts of future hazards.

Public Assistance Program

FEMA's Public Assistance (PA) grant program is authorized through the Stafford Act to provide federal assistance to government organizations and certain PNP organizations following a Presidential Disaster Declaration. This funding is provided at a 75%/25% cost share to allow government and certain PNP entities to respond and recover from major disasters or emergencies. The Public Assistance program returns damages to their pre-event condition.

Through the PA program, FEMA provides supplemental assistance in the following Categories:

Emergency Work

A. Debris Removal
B. Emergency Protective Measures

Permanent Work

C. Roads and Bridges
D. Water Control Facilities
E. Public Buildings and Contents

F. Public Utilities
G. Parks, Recreational, and other facilities

Section 406 of the Stafford Act provides FEMA with the authority to fund cost-effective mitigation measures to repair, restore, or replace eligible damaged facilities, and allows for those structures to be rebuilt or repaired to better than pre-disaster conditions to make them less vulnerable to future hazards. Unlike other hazard mitigation grant programs, 406 mitigation is only available in the counties declared in the presidential declaration and only for eligible damaged facilities.

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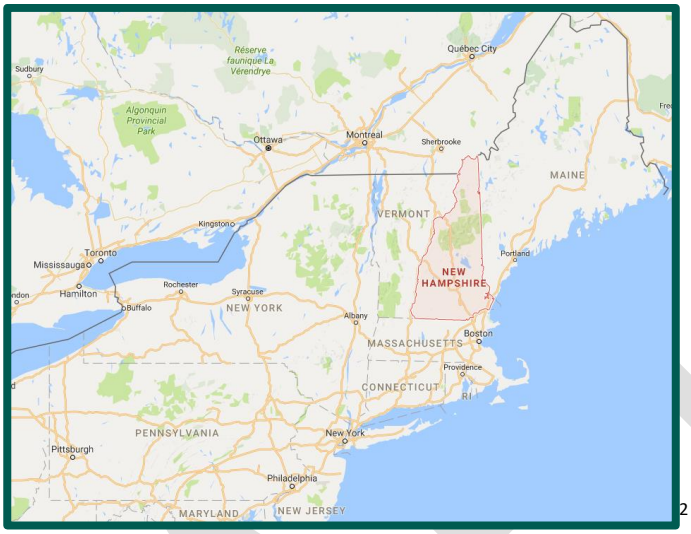
State Profile

State Overview

This section of the Plan provides a synopsis of the vital statistics for the State of New Hampshire.



[2]

The State of New Hampshire lies in the northeast section of the United States, bordered on the north by the Canadian Province of Quebec, on the east by Maine and the Atlantic Ocean, on the south by Massachusetts, and on the west by Vermont. The total area of the State is 9,351 square miles. Approximately 80% of the land area is rural and wooded. The State capital is Concord. According to the New Hampshire Office of Strategic Initiatives (OSI), formerly the Office of Energy and Planning, the total estimated population of New Hampshire (including unincorporated places) is just over 1.33 million persons. The State is divided into 10 counties and 234 incorporated cities and towns. County populations range from as few as 33,577 residents in Coos County to 404,322 in Hillsborough County. City and town populations range from as few as 42 residents in Hart's Location to 109,419 in the City of Manchester. Accordingly, the following are emergency-related situations that New Hampshire Faces:

- New Hampshire faces a wide array of risks, which may pose a significant threat to the population and property within the State. These include natural, technological and/or human-caused disasters or emergencies.
- Depending on the extent and nature of the disaster or emergency, the economic and physical infrastructure of the State and/or affected region may be severely hampered.
- During a disaster or emergency, the State will take immediate and appropriate actions to determine, direct, mobilize and coordinate the response in conjunction with local governments being impacted. The State will activate the necessary functions to redirect resources in order to save lives, relieve human suffering, sustain survivors, protect property, and repair essential facilities.
- A major or catastrophic disaster or emergency may overwhelm local governments in providing a timely and effective response to meet the needs of the situation, in which case the State will provide assistance to local governments. When the State's capacity to provide assistance has been exceeded, it will seek support from Emergency Management Assistance Compact (EMAC), International EMAC (IEMAC), or FEMA in addition to other compacts that may exist.

[2] Source: Google Maps

Geography and Climate

New Hampshire is divided roughly into two climate zones, north and south, that are delineated by the White Mountains. Contained within the Appalachian Highlands, the three primary physiographic regions of New Hampshire are the Coastal Lowlands, the Eastern New England Upland, and the White Mountain Region. The State experiences four seasons, including moderately warm summers and cold, wet winters. The climate of New Hampshire is influenced greatly by the presence of the Atlantic Ocean, which acts to moderate the temperature along the coast throughout the year and provide ample moisture for low pressure systems. Additionally, there are portions of the State within the White Mountains, such as Franconia Notch, where the steep terrain amplifies the severity of local weather, namely precipitation, year round.

Temperature varies greatly depending on the season, with below freezing temperatures during winter months and high temperatures above 90°F during warm spells in the summer. Average annual temperatures in New Hampshire vary significantly based on location, but tend to be between 37°F in the north and 46°F in the central part of the State. It is important to note, however, that these average annual temperatures do not provide an accurate representation of the temperature at any given time during the year.

Precipitation is brought to the State in the form of extratropical cyclones throughout most of the year, with convective precipitation more common in the warmer summer months. The distribution of precipitation is fairly even across the State, with increased values recorded at higher elevations and along the coast; but, these distributions of increased precipitation values can vary based on storm track. An example of this can be seen with coastal storms, often referred to as Nor'easters, which bring heavy precipitation in the form of snow, freezing rain, sleet, rain, or a combination of all of these, to coastal portions of the State. These storms may also bring heavy precipitation inland if the storm track is favorable. New Hampshire receives approximately 43.42 inches of precipitation annually, but local average annual precipitation values will vary based on elevation, latitude, and predominate wind direction[3].

Economy

Tourism is the State's leading industry. Many visitors and residents enjoy the State's beaches, mountains and lakes. The largest lake, Winnipesaukee, is dotted with 274 inhabitable islands, provides ample opportunity for fishing and water recreation sports. Along the Atlantic shore, 18 mi (29 km) of curving coastline boasts white sand beaches (many State-owned) which attract vacationers. In the winter, skiers flock northward to take advantage of the numerous ski mountains and the State has responded by greatly expanding its facilities. When the snow melts, the skiers are replaced with hikers, rafters, cyclists, and climbers.

The New Hampshire Motor Speedway (NHMS) is the largest sports facility in New Hampshire based upon seating capacity of 100,000 people. The venue hosts a NASCAR Monster Energy race in the early summer. The Speedway is also co-home (with Laconia) to the New Hampshire Motorcycle Week held in June with over 380,000 in attendance each year over the week-long event. A one-time weekend concert was approved in November of 2017. The venue will host an annual summer concert weekend, following

[3] https://www.cocorahs.org/Media/docs/ClimateSum_NH.pdf

recent approval from the Town of Loudon's Zoning Board. The first concert will take place sometime between June 1st and September 1st in 2018.[4]

Government

The State's executive branch is headed by a governor and five administrative officers called Executive Councilors. The Governor is elected for a two-year term. The New Hampshire bicameral legislature (General Court), consists of 24 senators and 400 representatives, all elected for two years. The State elects two senators and two representatives to the US Congress and has four electoral votes.

New Hampshire, like other New England States, is also unique for its tradition of local town meetings. In many towns, residents vote directly on municipal and school budgets and can propose and amend warrant articles. New Hampshire, like Vermont, is among the few states in the Nation that utilizes a strong, local government rather than a predominately county government structure.

Higher Education

Among the State's institutions of higher learning are the University System of New Hampshire (five Colleges/Universities), the Community College System of New Hampshire (seven Colleges/Institutes), and over a dozen additional private colleges, universities, and institutes of higher education.

Transportation Systems

Air Service

The Manchester-Boston Regional Airport (MHT[5]) is the State's largest commercial aviation airport and New England's third largest airport. Located in Manchester, New Hampshire, less than 50 miles north of Boston, Massachusetts, MHT is situated on 1,200 acres with a 308,000 sq. ft. terminal. It has two runways, 14 jet gates, eight rental car companies, 17 food/news concession stands, and an airport business center as well as other commercial, cargo, and general aviation services. The airport offers service with four airlines: American, Delta, Southwest, and United Airlines. The airport has short and long-term parking for over 11,000 vehicles and services approximately 150 commercial passenger, cargo, and general aviation operations per day processing 2 million passengers and 170 million pounds of cargo. The State also has two other primary airports offering commercial service:

Sunrise at Manchester Airport
(Source– Parker Moore)

- Lebanon Municipal Airport located in Lebanon, New Hampshire offering service with Cape Air
- Portsmouth International Airport at Pease in Portsmouth, New Hampshire offering service with Allegiant

The State has about a dozen other General Aviation Airports located throughout the State with the larger General Aviation Airports being located in Concord, Keene, Laconia, and Nashua (Boire Airfield).

[4] http://www.unionleader.com/local-government/Weekend-long-concert-approved-for-NHMS-but-with-conditions-11162017

[5] International Air Transport Association (IATA) and Federal Aviation Administration (FAA) airport code. International Civil Aviation Organization (ICAO) airport code is KMHT

Rail Service

There are 459 miles of active railroad in New Hampshire. The State is the largest railroad owner with over 200 miles of active line, purchased to preserve freight service to industry and promote tourism and economic development. Nine freight railroads operate in the State. Passenger rail service in New Hampshire is provided by the Amtrak Downeaster and services routes between Brunswick, ME and Haverhill, MA, with stops in Dover, Durham and Exeter. The Vermonter rail service has a stop at the Claremont Junction as well as Vermont communities in the Connecticut Valley.

Bus Service

There are numerous bus companies serving the citizens and guests of the State with regularly scheduled trips across the State, into Boston, as well as other long distance fares.

Road System

The State maintains 4,814 miles (7,747 km) of roads, of which 2,567 miles (4,131 km) are numbered routes and 1,465 miles (2,358 km) are unnumbered roadways. The State has 557 miles (896 km) of primary highways, which it defines as highways that "connect population centers, other National Highway Systems (NHS) routes within the State, and other NHS routes in the surrounding states: Vermont, Maine, and Massachusetts." The remaining 12,215 miles (19,658 km) of roads are maintained typically by the towns and cities traversed by these roads. Many minor State highways do not have assigned numbers, only local names.

- Interstate highways: A total of 224.2 miles (360.8 km) of roadway in New Hampshire are part of the Interstate Highway System.
    - Three primary Interstates and two secondary Interstates pass through New Hampshire:
        - Interstate 89 (I-89)
        - Interstate 93 (I-93)
            - I-293
            - I-393
        - Interstate 95 (I-95)
- Turnpike System:
    - The Frederick E. Everett Turnpike
    - The Eastern Turnpike, which is composed of the following two connecting turnpikes:
        - The Blue Star Turnpike (also known as the New Hampshire Turnpike)
        - The Spaulding Turnpike

Electric Power Generation

Fifty-seven power generation facilities within the State of New Hampshire produce more than one megawatt (MW) of power or more. These facilities provide electric power to residential and commercial users across the State. New Hampshire also directly receives power from two facilities in the State of Vermont. The following is a fuel type break down of the 57 >1MW power generating facilities:

- 2 Bio Gas
- 2 Coal
- 1 Fuel Oil #2
- 33 Hydro
- 2 Natural Gas
- 1 Nuclear
- 2 Solid Waste
- 5 Wind
- 9 Wood

The State's sole Nuclear Power Facility, NextEra Energy Seabrook Station (SS), located in Seabrook, New Hampshire is positioned on 900 acres; it is a pressurized water reactor (PWR) that generates 1,250 MW of electricity. The plant began construction in 1976 and began operations in 1990.

Population Changes and Estimations

This Plan update falls within the 2010 and 2020 censuses, creating the need to use estimations for population growth across the State. 2010 census data showed that between the years of 2000 to 2010, New Hampshire's population saw an increase of 80,700, the smallest gain in New Hampshire's history since roughly 1950. A dwindling population growth is partly to blame as there were fewer people migrating into New Hampshire from other states between 2000 and 2010 (51.8 % of residents were not born in the State). Additionally, the population growth rate continued to be stunted by a death rate larger than the birth rate, and the fact that many young adults and families chose to leave New Hampshire.

Population estimate data is provided by the New Hampshire Office of Strategic Initiatives (NH OSI) for each town, county, and the State as a whole on a yearly basis. The most recent data available at the time that this Plan was written were the 2016 Population Estimates[6]. Between the years of 2010 and 2016, it was estimated that the population within the State of New Hampshire grew by approximately 18,335 people. Hillsborough County showed the largest amount growth with a population increase of approximately 5,026 people, while Sullivan County saw a decrease of 64 people.

NH OSI, in partnership with the State's Regional Planning Commissions (RPCs), also provides State and county population projections based on age. These reports utilize census data, migration data, fertility data, special populations data (such as colleges, military and prisons), and birth and death records from the New Hampshire Department of State, Division of Vital Records Administration, among other data sources. The most recent report was completed in 2016 and offers the following probable population trends which extend out to 2040[7]:

- The total New Hampshire state population is projected to be 1,432,730 in 2040, an increase of 116,260 or 8.8 percent from the 2010 Census population of 1,316,470.
- The absolute number of births will decline slightly from about 66,000 in the 2010 to 2015 period to 65,000 in the 2035 to 2040 period. This will result from continued low levels of fertility but a relatively large millennial generation population.
- The number of deaths will increase sharply from 56,500 in the 2010 to 2015 period to nearly 96,000 in the 2035 to 2040 period due to the aging of the Baby Boom generation.
- By 2040, every New Hampshire county is projected to experience natural decline – an excess of deaths over births.
- The population age 65 and over will increase from 178,268 in 2010 to 408,522 in 2040, an increase of 230,200.
- The population under age 15 will decline from 232,182 in 2010 to 214,819 in 2040 and fall from 17.6 percent to 15.0 percent as a proportion of the total population.

[6] https://www.nh.gov/osi/data-center/documents/population-estimates-2016.pdf
[7] https://www.nh.gov/osi/data-center/documents/2016-state-county-projections-final-report.pdf

Population estimates for the State of New Hampshire by county based on a joint study by NH OSI and RPCs.
(Source– NH OSI)

	2010	2015	2020	2025	2030	2035	2040
New Hampshire	1,316,470	1,330,501	1,349,908	1,374,702	1,402,878	1,422,530	1,432,730
Belknap	60,088	60,407	61,340	62,330	63,333	64,336	65,361
Carroll	47,818	47,968	48,239	48,858	49,792	50,245	50,192
Cheshire	77,117	77,345	77,653	78,002	78,315	78,543	78,695
Coos	33,055	33,652	32,389	31,206	30,059	28,919	27,756
Grafton	89,118	89,418	91,099	92,815	94,829	97,142	99,673
Hillsborough	400,721	404,295	409,478	416,445	424,492	429,538	431,284
Merrimack	146,445	147,780	150,434	154,459	159,899	164,046	166,771
Rockingham	295,223	300,575	307,013	314,418	321,441	325,474	326,238
Strafford	123,143	125,334	128,801	132,513	136,472	139,738	142,204
Sullivan	43,742	43,727	43,462	43,656	44,246	44,549	44,556

Current and Future Development Trends

Historically, New Hampshire has relied on paper and grain mills as the primary monetary providers in the State, but the decline of mill work throughout the 20th century has prompted a transition, giving rise to smart technology manufacturing, tourism, and health care as the main drivers of the State's economy[8]. These fields in particular have grown more quickly than others as the State works to open itself up for new manufacturing businesses, advertises the adventures possible throughout its abundant natural resources, works to fill the increased demand for skilled health care providers brought on by an aging population, and provides real-estate and incentives for the rapidly expanding biomedical industry in New England. Examples of this growth can be seen in the addition of Safran Aerospace Composites and Albany Engineered Composites, which integrated their companies into a manufacturing plant in Rochester, New Hampshire[9], the expansion of ski mountains and resorts and continued improvement projects to New Hampshire trails and recreational areas[10], and the addition of the Advanced Regenerative Manufacturing Institute (ARMI) to the Manchester Millyard, which allows for the biomedical field to expand in a region now being dubbed the "mini-Cambridge"[11].

The Department of Resources and Economic Development (DRED) underwent reorganization in July of 2017 as a result of Governor Chris Sununu's plan to refocus the Divisions of Economic Development and Travel and Tourism Development into the Department of Business and Economic Affairs. This was done in an effort to focus on business recruitment and economic development in the State. The project has focused on branding New Hampshire as "Open for Business" and includes a new State website[12] for the Division of Economic Development that focused on why New Hampshire is the right location for businesses and how companies can move, start, and grow their business in the State. Additionally, the program has highlighted the advantages business will have in New Hampshire, such as a low taxes and incentives, high quality of life in the State, and a skilled and plentiful workforce. New Hampshire is known to have one of the highest percentages of college educated citizens in the nation and consistently ranks high for the rate of people employed in the fields of science and technology[13].

[8] https://stateimpact.npr.org/new-hampshire/tag/newhampshireeconomy/
[9] https://www.nheconomy.com/aerospace/index.html
[10] http://www.nhstateparks.org/
[11] http://www.nhbr.com/June-23-2017/States-biotech-industry-poises-for-further-growth/
[12] https://www.nheconomy.com/
[13] https://www.nheconomy.com/why-new-hampshire/skilled-and-educated-workforce

It is expected that growth will continue long term across the State as the government puts resources into branding and advertising the State as one that is business friendly.

Development in Hazard Prone Areas

Currently the State implements State Executive Order 96-4, *an Order for State agencies to comply with floodplain management requirements.* This Executive Order, signed by Governor Merrill in 1996, requires all State agencies to comply with the flood plain management requirements of all local communities participating in the National Flood Insurance Program in which State-owned properties are located.

All other development requirements for hazard areas (i.e. floodplains, steep slopes, wetlands, etc.) are implemented at the local level through community Zoning Ordinances, Subdivision Regulations and Site Plan Regulations.

State Building Code

The State of New Hampshire has adopted building codes which govern both residential and non-residential structures. The New Hampshire State Building Code uses the 2009 International Residential Code (IRC) and the 2009 International Building Code (IBC) as base standards for the State codes for residential and non-residential structures, respectively. There are other code standards which govern non-structural areas of design, all of which can be found at the State of New Hampshire Building Code website[14].

Many communities in New Hampshire do not have building code enforcement officials. This does not relieve the owner or design professional from meeting the requirements of the New Hampshire State Building Code in those communities without code enforcement. Not every community in New Hampshire enforces the requirements in IBC 2009, Chapter 17, for special inspections of structures.

Upon review of local hazard mitigation plans, many of the New Hampshire communities follow their own guidelines when it comes to planning and development in hazard prone areas.

National Flood Insurance Program

The Office of Strategic Initiatives (OSI) administers and coordinates the State's role in the National Flood Insurance Program (NFIP). The NFIP is a Federal program administered by the Federal Emergency Management Agency (FEMA) that allows property owners in participating communities to purchase insurance protection against losses from flooding. Communities can voluntarily participate in the NFIP by making an agreement with FEMA and adopting and enforcing floodplain regulations to reduce the flood risks of new construction in FEMA's designated special flood hazard areas.

Currently, 219 out of 234 New Hampshire communities participate in the NFIP and have adopted at least the minimum standards of the NFIP, which regulate development in the 100-year, or 0.1% annual chance, floodplain. The regulations mitigate flood damage by requiring new and substantially improved structures to be elevated, or for non-residential structures, flood proofed to, or above the 0.1% annual chance Base Flood Elevation (BFE).

NH OSI conducts approximately eight community assistance visits and formal contacts each year to ensure that participating communities have the proper regulations, as well as to educate the local

[14] http://www.nh.gov/safety/boardsandcommissions/bldgcode/nhstatebldgcode.html

officials as to their NFIP responsibilities and to offer technical assistance on the NFIP. This initiative is reflected in Goal X, Objective G of the State's Goals & Objectives in Chapter VII of this Plan. OSI also provides general technical assistance related to the NFIP to local officials, the public, surveyors, realtors, and others by phone and email on a regular basis. These contacts along with annual workshops and training, a quarterly NFIP newsletter, and information made available on OSI's website play a vital role in ensuring that the primary goal of the NFIP, to reduce the loss of life and property due to flooding, is implemented.

National Flood Insurance Program Statistics

County	NFIP Policies	Insurance in Force	Total Paid Losses	Total Paid Amount	Total Relative Loss Properties	Total Severe Repetitive Loss Properties
Belknap	274	$57,969,700	114	$980,205	14	2
Carroll	407	$96,249,300	267	$2,167,923	15	1
Cheshire	504	$111,809,100	227	$6,274,330	17	0
Coos	159	$28,161,800	84	$501,493	5	0
Grafton	851	$173,106,100	342	$4,466,566	31	0
Hillsborough	1,196	$297,492,000	587	$9,908,964	73	1
Merrimack	512	$127,401,500	295	$6,293,111	51	0
Rockingham	3,844	$824,466,200	1,818	$17,648,546	158	4
Strafford	292	$73,523,200	132	$2,213,315	14	1
Sullivan	165	$37,816,600	43	$392,796	2	0
Total:	**8,204**	**$1,827,995,500**	**3,909**	**$50,847,249**	**380**	**9**

"Repetitive Loss" means flood related damaged sustained by a structure on two separate occasion during a 10-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds 25 percent of the market value of the structure before the damage occurred. *Source: NH OSI, April 2018.*

NH OSI is also in the process of updating the State model floodplain ordinance to make it easier for community's to use to meet NFIP minimum floodplain management standards and to encourage higher regulatory standards that can increase community resilience to flooding and earn communities credit through the Community Rating System (CRS) if they participate.

With respect to hazard mitigation, the OSI NFIP staff's goal is to reduce the loss of life and property damage due to flooding. The OSI NFIP staff works with the State Hazard Mitigation Team in identifying and approving Hazard Mitigation Grant Program (HMGP) and Flood Mitigation Assistance (FMA) grants. The Biggert Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claim (RPC) and Severe Repetitive Loss (SRL) programs and moved their functions under the FMA program.

Community Rating System

The Community Rating System (CRS) is a voluntary incentive program that encourages communities to adopt and enforce floodplain regulations and activities that go beyond the NFIP minimum requirements. The objective of CRS is to reward communities that are doing more than meeting the NFIP requirements by reducing the flood insurance premiums of their residents by a certain percentage. Since the previous plan, the State of New Hampshire communities that currently participate in CRS has increased from four to five. These communities are listed in the table below. Each one has a local hazard mitigation plan and is eligible to receive funding for flood mitigation projects.

CRS Communities in New Hampshire

COMMUNITY	CRS CLASS	PREMIUM DISCOUNT
Keene	8	10%
Marlborough	9	5%
Nashua	8	10%
Peterborough	8	10%
Winchester	9	5%

Hazard Identification and Risk Assessment

Introduction

The impact of expected, but unpredictable, natural, technological, and human-caused events can be reduced through emergency management and strategic planning. That planning must be grounded in the rational evaluation of the hazards and the risks they pose in order to prioritize actions designed to mitigate their effects. The first step in hazard mitigation is to identify the threats and hazards that have the potential to impact the State of New Hampshire. The 2013 State Hazard Mitigation Plan's Hazard Identification and Risk Assessment (HIRA) identified the following threats and hazards:

2013 State Multi-Hazard Mitigation Plan Identified Hazards		
Flooding	Coastal Flooding	Dam Failure
Drought	Wildfire	Earthquake
Landslide	Radon	Tornado/Downburst
Hurricane	Lightning	Severe Winter Weather
Snow Avalanche	Epidemic/Pandemic	Fire and Hazardous Materials
	Terrorism	

Threat and Hazard Identification and Risk Assessment (THIRA) Integration

Presidential Policy Directive 8 (PPD-8) is aimed at strengthening the security and resilience of the United States through systematic preparation for the threats that pose the greatest risk to the security of the Nation, including acts of terrorism, cyber-attacks, pandemics, and catastrophic natural disasters. National Preparedness is the shared responsibility of all levels of government, the private and non-profit sectors, and individual citizens within the Nation. Everyone has the ability to contribute to safeguarding the Nation from harm. PPD-8 aims to facilitate an integrated, nation-wide, capabilities-based approach to preparedness. The State of New Hampshire is required to complete a THIRA/SPR report as a condition of receiving federal funding for the Emergency Management Performance Grant (EMPG) Program and the Homeland Security Grant Program (HSGP), due December 31st of each year. Under new guidance and methodology from FEMA released in 2018, the reporting period for the THIRA/SPR has changed to the following: 2018—the THIRA/SPR will only be completed for cross-cutting, Response, and Recovery core capabilities; 2019—the THIRA/SPR will be completed for all core capabilities; 2020-2022—beginning in 2020, the THIRA/SPR will be completed on a new three year cycle where the only an update of the SPR will be required during the first two years, and a complete THIRA/SPR report will be due at the end of the third year for all core capabilities.

HSEM prepared the THIRA/SPR with cooperation from over a dozen other agencies including state agencies, local communities, and private and non-profit sectors involved in all five mission areas of emergency management while following guidance from FEMA's Comprehensive Preparedness Guide (CPG) 201, Third Edition, May 2018. The THIRA process helps communities determine:

- A jurisdiction's plausible catastrophic events – natural, technological, and human-caused,
- Impacts of the specified events,
- Core capability targets related to impacts,
- Capability estimation of resources required to be better prepared, including shared resources, and
- Actions that could be employed to avoid, divert, lessen, or eliminate a threat or hazard.

The THIRA is a scenario based review of the threats and hazards of most concern to the State that provides impacts of scenario driven threats and hazards along with desired response outcomes. From this information, the State develops *Capability Targets* which describe what the State seeks to be able to be prepared for and then identifies the resources required to meet the *Capability Targets*. The THIRA differs from a traditional Hazard Identification and Risk Assessment (HIRA) in that it only looks at specific hazards deemed to have the largest impact(s) to the State and relies on realistic scenarios; whereas a traditional HIRA is broader in nature and looks at potential hazards, their probability of occurrence, and their potential impacts – no matter how small or large. The THIRA methodology provides a framework for emergency management organizations to define threats and hazards of concern to the State and its communities and assess the capabilities desired by the agencies designated to respond to the consequences of these threats and hazards.

The basis for the 2017 THIRA is the 2013 State Multi-Hazard Mitigation Plan's HIRA and the 2014-2016 THIRAs. This allows for the opportunity to review the threats and hazards of greatest concern to the state based upon probability as well as recent events occurring within the State, the Nation, and the World. The THIRA and HIRA are able to be built off of each other continuously as each one is updated. The 2017 THIRA includes several threats and hazards which were not included in the 2013 SHMP; the threats and hazards from the 2017 THIRA are being included in this Plan. The 2017 THIRA incorporated the following threats and hazards:

2017 THIRA Threats and Hazards		
Natural Hazards	Technological Hazards	Human-caused Hazards
• Earthquake • Flood • Hurricane / Typhoon • Winter Storm / Ice storm	• Hazmat Release – Chemical • Hazmat Release – Radiological	• Active Shooter • Cyber Attack • Explosive Devices • Fire--Structural

2018 State Multi-Hazard Mitigation Plan Update Hazard Identification

As a result of the input from the State Hazard Mitigation Plan Update Committee and review of local hazard mitigation plans, one hazard was removed and ten hazards were added to make a total of 25 hazards assessed. The following threats and hazards are included, assessed, and reviewed in the 2018 SHMP:

2018 SHMP Identified Hazards		
Natural Hazards	Technological Hazards	Human-caused Hazards
• Avalanche • Coastal Flooding • Inland Flooding • Drought • Earthquake • Extreme Temperatures • High Wind Events • Infectious Diseases • Landslide • Lightning • Severe Winter Weather • Solar Storm and Space Weather • Tropical and Post-Tropical Cyclones • Wildfire	• Aging Infrastructure • Conflagration • Dam Failure • Hazardous Materials • Known and Emerging Contaminates • Long Term Utility Outage • Radiological	• Cyber Event • Mass Casualty Incident • Terrorism/Violence • Transport Accident

Information on hazards was also gained by the review of the FEMA approved Local Hazard Mitigation Plans within the State of New Hampshire.

Hazard Changes between 2013 and 2018 Plans

2013 Threats and Hazards	2018 Threats and Hazards	Description of change(s)
	ADDED - Aging Infrastructure	Added to address failure of infrastructure and Critical Infrastructure due to age and degradation
Coastal Flooding	Coastal Flooding	No Change
	ADDED - Conflagration	Added to address major structural fires involving numerous buildings in close proximity
	ADDED - Cyber Event	Added to incorporate Cyber Events relating to intentional and unintentional cyber issues as well as cyber terrorism
Dam Failure	Dam Failure	No Change
Drought	Drought	No Change
Earthquake	Earthquake	No Change
	ADDED - Extreme Temperatures	Added to address extreme heat and cold events
Epidemic/Pandemic	Infectious Diseases	Hazard Name Change
Fire and Hazardous Materials	Hazardous Materials	Hazard Name Change, fire moved to conflagration section, radiological moved to separate section
Flooding	Inland Flooding	Hazard Name Change
	ADDED – Known and Emerging Contaminates	Added to address contaminates to ground water and soil such as PFOA
Hurricane	Tropical and Post-Tropical Cyclones	Hazard Name Change, done to accommodate all types of tropical weather systems
Landslide	Landslide	No Change
Lightning	Lightning	No Change
	ADDED - Long Term Utility Outage	Added to address loss of utilities for an extended period of time secondary to an event/other hazard.
	ADDED – Mass Casualty Incident	Added to address MCI events
	ADDED - Radiological	Added to specifically address radiological hazards
Radon	**REMOVED**	Although it is acknowledged that Radon exists within the State of New Hampshire, the Radon Program was cut in 2011. Therefore, updated and reliable information on the hazard is not currently available. Property owners should consider testing for radon and mitigating as appropriate.
Severe Winter Weather	Severe Winter Weather	No Change
	ADDED – Solar Storm and Space Weather	Added to address solar storms & space weather and its effect on communications and infrastructure
Snow Avalanche	Avalanche	Hazard Name Change
	ADDED - Transport Accident	Incorporates aviation accidents, rail accidents, nautical accidents, and major motor vehicle accidents
Terrorism	Terrorism/Violence	Hazard Name Change, Incorporates Terrorism, Explosive Devices/IEDs, and major criminal incidents.
Tornado/Downburst	High Wind Events	Hazard Name Change
Wildfire	Wildfire	No Change

History of Disaster Declarations in New Hampshire

The State of New Hampshire has received 51 disaster declarations, including Presidential Declarations (DR) and Emergency Declarations (EM), since 1953 that amount to over $197 million in federal assistance. These were the result of multiple hazard types, with the most common being flooding and severe winter weather events. Since the 2013 Plan, there have been 7 major disaster declarations.

List of Major Disaster Declarations

Disaster Number (DR)	Declaration Date	Event	Program	Amount	Counties Declared
11	7/2/1953	Forest Fire	UNK	UNK	Shaw Mountain in Ossipee, 2500 acres burned
327	3/18/1972	Coastal Storms	UNK	UNK	Unknown
399	7/11/1973	SEVERE STORMS, FLOODING	UNK	UNK	Unknown
411	1/21/1974	Heavy Rains, Flooding	UNK	UNK	Unknown
549	2/16/1978	High Winds, Tidal Surge, Coastal Flooding	UNK	UNK	Unknown
771	8/27/1986	SEVERE STORMS, FLOODING	PA	$1,005,000	Cheshire & Hillsborough
789	4/16/1987	SEVERE STORMS, FLOODING	PA/IA	$4,888,889	Carroll, Cheshire, Grafton, Hillsborough, Merrimack, Rockingham, and Sullivan
876	8/29/1990	Flooding, Severe Storm	PA	$2,297,777	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, and Sullivan
917	9/9/1991	Hurricane Bob, Severe Storm	PA	$2,293,449	Statewide
923	11/13/1991	Severe Coastal Storm	PA/IA	$1,500,000	Rockingham
1077	1/3/1996	Storms/Floods	PA	$2,220,384	Carroll, Cheshire, Coos, Grafton, Merrimack, and Sullivan
1144	10/29/1996	Severe Storms/Flooding	PA	$2,341,273	Grafton, Hillsborough, Merrimack, Rockingham, Strafford and Sullivan,
1199	1/15/1998	Ice Storms	PA/IA	$12,446,202	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Strafford, Sullivan
1231	7/2/1998	Severe Storms and Flooding	PA/IA	$3,420,120	Belknap, Carroll, Grafton, Merrimack, Rockingham and Sullivan
1305	10/18/1999	Tropical Storm Floyd	PA	$750,133	Grafton, Belknap and Cheshire
1489	9/12/2003	Severe Storms and Flooding	PA	$1,300,000	Cheshire and Sullivan
1610	10/26/2005	Severe Storms and Flooding	PA/IA	$14,996,626 +	Belknap, Cheshire, Hillsboro, Merrimack and Sullivan. Grafton
1643	5/25/2006	Severe Storms and Flooding	PA/IA	$17,691,586 +	Belknap, Carroll, Hillsboro, Merrimack, Rockingham, Strafford and Grafton
1695	4/27/2007	Severe Storms and Flooding	PA/IA	$27,000,000+	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan.
1782	8/11/2008	Severe Storms, Tornado, and Flooding	PA	$1,691,240	Belknap, Carroll, Merrimack, Rockingham, and Strafford
1787	9/5/2008	Severe Storms and Flooding	PA	$4,967,595	Belknap, Coos, and Grafton
1799	10/3/2008	Severe Storms and Flooding	PA	$1,050,147	Hillsborough and Merrimack
1812	1/2/2009	December '08 Ice Storm	PA/DFA	$19,789,657	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
1892	3/29/2010	Severe Winter Storm	PA	$9,103,138	Merrimack, Rockingham, Strafford, and Sullivan
1913	5/12/2010	Severe Storms and Flooding	PA	$3,057,473	Rockingham and Hillsborough
4006	7/22/2011	Severe Storms and Flooding	PA	$1,664,140	Grafton and Coos
4026	9/3/2011	Tropical Storm Irene	PA/IA	$19,789,657	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
4049	12/5/2011	October Nor'easter	PA	$9,103,138	Merrimack, Rockingham, Strafford, and Sullivan
4065	6/15/2012	Severe Storm and Flooding	PA	$3,057,473	Rockingham and Hillsborough
4095	11/28/2012	Hurricane Sandy	PA/DFA	$1,664,140	Grafton and Coos
4105	3/19/2013	Severe Winter Storm	PA	$19,789,657	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan

List of Major Disaster Declarations *(cont…)*

**This table shows the major disaster declarations since 2013 Plan.*

Disaster Number (DR)	Declaration Date	Event	Program	Amount	Counties Declared
4139	08/02/2013	Severe Storms, Flooding, and Landslides	PA	$6,408,896	Cheshire, Grafton, Sullivan
4209	03/25/2015	Severe Winter Storm and Snowstorm	PA	$4,939,214	Hillsborough, Rockingham, Strafford
4316	06/01/2017	Severe Winter Storm	PA	$2,143,536	Belknap and Carroll
4329	08/09/2017	Severe Storms and Flooding	PA	$11,802,065	Grafton
4355	01/2/2018	Oct. 30 Storms & Flooding	PA	$6,093,232	Belknap, Carroll, Coos, Grafton, Sullivan, Merrimack
4370	06/08/2018	Severe Storms and Flooding	PA	TBD	Rockingham
4371	06/08/2018	Severe Winter Storm and Snowstorm	PA	TBD	Carroll, Strafford, and Rockingham

List of Emergency Declarations

Disaster Number (EM)	Declaration Date	Event	Program	Amount	Counties Declared
3073	3/15/1979	Flooding	UNK	UNK	UNKNOWN
3101	3/16/1993	Blizzards, High Winds and Record Snowfall	PA	$832,396	Statewide
3166	3/28/2001	Snowstorm	PA	$4,500,000	Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, and Strafford
3177	3/11/2003	Snowstorm	PA	$3,000,000	Cheshire, Hillsborough, Merrimack, Rockingham and Strafford
3193	1/15/2004	Snow	PA	$3,200,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack and Sullivan
3207	3/30/2005	Snow	PA	$4,654,738	Belknap, Carroll, Cheshire, Grafton, Hillsboro, Merrimack, Rockingham, Strafford and Sullivan
3208	3/30/2005	Snow	PA	$1,417,129	Carroll, Cheshire, Coos, Grafton and Sullivan
3211	4/28/2005	Snow	PA	$2,677,536	Carroll, Cheshire, Hillsboro, Rockingham and Sullivan
3258	9/19/2005	Hurricane Katrina Evacuation	PA	$9,887.40	Statewide
3297	12/13/2008	Severe Winter Storm	DFA/PA	$900,000	Belknap, Carroll, Cheshire, Coos, Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan
3333	8/27/2011	Hurricane Irene	PA	$550,618.32	Statewide
3344	11/1/2011	Severe Storm	None	$0	Statewide
3360	10/30/2012	Hurricane Sandy	PA	$644,300.52	Statewide

PA – Public Assistance DFA – Direct Federal Assistance IA – Individual Assistance

List of Non-Declared Major Events since 2013

Event Date	Event Description	Impacts	Location	Additional Information
January 2014	Fuel Oil Interruption during extreme cold	Lack of Oil Delivery	Capital Region	SEOC Activated as a call center to support customers running out of oil
April 15-16, 2014	Severe Storm & Flooding	$1.9M Damages	Coos & Carroll	Columbia Lyman Brook Bridge Destroyed
Nov 26-29, 2014	Severe Winter Storm	217,000 Outages	Statewide	5th Largest power outage event in New Hampshire history
April 21, 2016	Stoddard Fire	$500,000 Damages	Stoddard, NH	SEOC Activated to assist in large wildfire.

Hazard Profiles and History of Events

This section contains a compilation of information related to the hazards identified in this Plan's HIRA, which includes the definition of the hazard, where the hazard impacts the State, the extent of the hazard, the impacts of the hazard, previous occurrences, summation of future risk, and the highest probable extent of the hazard which could impact the location and/or the State.

Natural Hazards

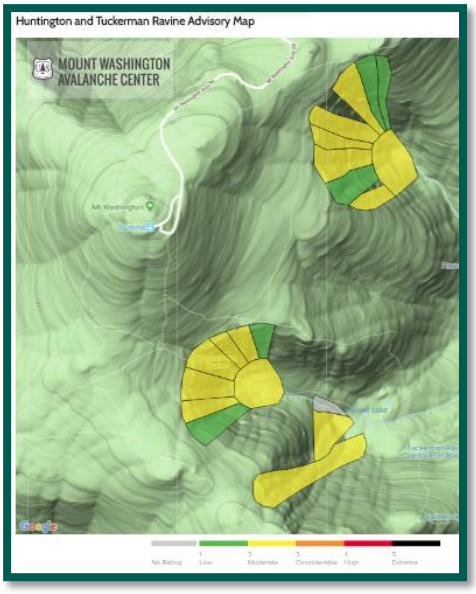
Avalanche

HIRA Risk: Low
Future Probability: Medium
Counties at Risk: Carrol, Coos, Grafton Counties

Definition:
An avalanche is a slope failure consisting of a mass of rapidly moving, fluidized snow that slides down a mountainside. The flow can be composed of snow, ice, water, soil, rocks, and trees. An avalanche can be comparable to a landslide; only with snow instead of earth.[15]

Location:
The mountainous regions of Carroll, Coos, and Grafton counties are at risk for avalanches.

Background and evolving hazard information:
Natural and human-caused snow avalanches most often result from structural weaknesses of mountainside and unstable snow and ice formations. Heavy snowfall followed by high winds often create areas of unstable snow accumulations that can be set in motion by human activities, such as hiking, ice climbing, skiing, and snowboarding. There are two types of avalanches, a surface avalanche and a full-depth avalanche. A surface avalanche occurs when a layer of snow slides along another layer of snow with different properties/composition. A full-depth avalanche occurs when all layers of snow from snow surface to ground slide over the ground.



Avalanches are well known to occur on New Hampshire's Mount Washington, which is 6,288 feet and is the tallest mountain in the northeastern United States. Mount Washington has its own Avalanche Center which monitors the mountain's conditions and advises on avalanche conditions. These advisories offer specific information Huntington and Tuckerman Ravines, including current snowpack conditions, cause of snowpack instability, safety recommendations, and weather forecast information. Certain areas of the mountain may be closed as a result of avalanche danger. Examples of advisory maps and advisories from the Mt. Washington can be seen to the right. The National Weather Service in Gray, ME has teamed up with the Mount Washington Avalanche Center

[15] http://www.naturaldisasters.ednet.ns.ca/Projects/Avalanche/bja.htm

to relay Backcountry Avalanche Warnings to the public through their established messaging and broadcast channels.

Extent:

The extent of an avalanche prone area is determined by the amount of risk for natural or human triggered reactions based on factors such as snow pack distribution and other atmospheric conditions. The North American Public Avalanche Danger Scale below shows the five danger classifications that are used to express avalanche risk.

North American Public Avalanche Danger Scale

Avalanche danger is determined by the likelihood, size, and distribution of avalanches.

Danger Level	Travel Advice	Likelihood of Avalanches	Avalanche Size and Distribution
Extreme	Avoid all avalanche terrain.	Natural and human-triggered avalanches certain.	Large to very large avalanches in many areas.
High	Very dangerous avalanche conditions. Travel in avalanche terrain is not recommended	Natural avalanches likely; human-triggered avalanches very likely.	Large avalanches in many areas; or very large avalanches in specific areas.
Considerable	Dangerous avalanche conditions. Careful snowpack evaluation, cautious route-finding, and conservative decision-making essential.	Natural avalanches possible; human-triggered avalanches likely.	Small avalanches in many areas; or large avalanches in specific areas; or very large avalanches in isolated areas.
Moderate	Heightened avalanche conditions on specific terrain features. Evaluate snow and terrain carefully; identify features of concern.	Natural avalanches unlikely; human-triggered avalanches possible.	Small avalanches in specific areas; or large avalanches in isolated areas.
Low	Generally safe avalanche conditions. Watch for unstable snow on isolated terrain features.	Natural and human-triggered avalanches unlikely.	Small avalanches in isolated areas or in extreme terrain.

Safe backcountry travel requires training and experience. You control your own risk by choosing where, when, and how you travel.

General Bulletin	Issued when areas of unstable snow may exist but are isolated within the forecast areas. Natural and human-triggered avalanche activity may occur. Make your own snow stability assessments and terrain choices.

Impacts:

Avalanches present a significant threat to hikers, skiers, and other people recreating on the mountain. Falling ice and rocks can cause injury or death. Cracks, holes, and crevasses in the snowpack can cause individuals to become trapped or buried in snow, which can result in extreme cold injuries, suffocation, and possibly death.

Avalanches are a common occurrence in high terrain areas in New Hampshire during the winter and spring months. Enhanced warning capabilities have allowed for people engaging in outdoor activities in these areas during avalanche season to be more prepared for the conditions and make smart choices when choosing to venture into these areas. That said, it is expected that the need for rescues due to avalanches will continue into the future, especially as the popularity of extreme winter sports continues to increase.

Previous Occurrences[16][17]:

Event Date	Event Description	Impacts	Location	Additional Information
01/05/1997	Avalanche	Fatality	Mt. Washington	One fatality in an avalanche.
11/29/2003	Avalanche	Injuries and Deaths	Mt. Washington	Large avalanche, 100+ yrds of debris, 100ft fall, 2 deaths from trauma.
2012	Mt. Washington Events	Injuries, Rescues, and Deaths	Mt. Washington	2 confirmed deaths and 10 rescues
01/03/2012	Avalanche	Near-miss	Mt. Washington	Two skiers triggered a small avalanche
01/01/2013	Avalanche	Injured	Mt. Washington	3 climbers swept over the edge in Central Gully in Huntington Ravine were injured
03/01/2013	Avalanche	Fatality	Mt. Washington	Ice climber died from injuries sustained in an avalanche in Pinnacle Gully
03/29/2015	Avalanches	Minor injuries	Mt. Washington	6 avalanches in one day, 4 of which were triggered by humans, only one avalanche resulted in minor injuries.
01/17/2016	Avalanche	Minor injuries	Mt. Washington	2 hikers and a skier suffered minor injuries during an avalanche on Tuckerman Ravine.
04/02/2017	Avalanche	Near-miss	Mt. Washington	Two skiers triggered an avalanche on an area of the mountain known as “the Duchess”

[16] http://publications.americanalpineclub.org/articles/13200307300/Avalanche-Poor-Position-Inadequate-Equipment-New-Hampshire-Mount-Washington-Tuckerman-Ravine

[17] http://www.unionleader.com/Avalanche-carries-pair-down-Tuckerman-Ravine

Coastal Flooding

HIRA Risk: High
Future Probability: High
Counties at Risk: Rockingham and Strafford Counties

Definition:

Coastal flooding is defined by the National Oceanic and Atmospheric Administration (NOAA) as flooding which occurs when water is driven onto land from an adjacent body of water. This generally occurs when there are significant storms, such as tropical and extratropical cyclones.[18] Coastal flooding can also occur with high tides in many locations. Also described as "nuisance", "sunny-day" and "recurrent" flooding, minor high tide flooding is becoming increasingly common with little or no concurrent storm effects.[19,20] By definition, flooding in coastal areas caused by precipitation is considered inland (riverine) flooding; however it is important to note that the combination of heavy rain and coastal flooding can lead to compound flooding in coastal regions.[21] Coastal flooding not only results in the many problems identified for riverine flooding, but could also include additional issues resulting from storms and/or recurrent flooding. These problems can include, but are not limited to—beach and shoreline erosion; loss or submergence of wetlands, other coastal ecosystems, and developed land; impacts from saltwater intrusion and high groundwater tables; loss of coastal structures (sea walls, piers, bulkheads, bridges, or buildings); overwhelmed public infrastructure; water quality impairments; and hazardous waste exposure. Loss of life and property damage can be more severe in coastal storm events due to velocity wave action and accompanying winds.

Location:

New Hampshire has 235 miles of coastline, including 18.57 miles of shoreline exposed to the Atlantic Ocean (New Hampshire Office of Strategic Initiatives) and 217 miles of tidally-influenced shoreline within the Great Bay and Hampton-Seabrook estuaries.[22] Seventeen municipalities form the New Hampshire Coastal Zone within Rockingham and Strafford counties as shown in the map below.[23] In New Hampshire, coastal flooding can occur in any of these 17 coastal zone municipalities.

Atlantic Coast Municipalities: New Hampshire's seven Atlantic Coast communities include Hampton, Hampton Falls, North Hampton, New Castle, Portsmouth, Rye, and Seabrook. These communities are located in the southeastern corner of the State and are directly exposed to the Atlantic Ocean. The Atlantic Coast is characterized by tidal and riverine systems and landforms. The southern Atlantic Coast consists of a barrier beach system including the extensive salt marshes of the Hampton-Seabrook Estuary, a broad sand beach at Hampton, and dune systems in Hampton and Seabrook. The northern Atlantic Coast is marked by prominent bedrock headlands, small cove beaches, and tidal waterways that extend far inland. The primary inland riverine systems include the Taylor River and Winnicut River.

[18] NOAA Coastal Flooding Definition http://w1.weather.gov/glossary/index.php?letter=c
[19] Sweet and Marra (2016). https://www.ncdc.noaa.gov/monitoring-content/sotc/national/2016/may/sweet-marra-nuisance-flooding-2015.pdf
[20] NOAA. https://oceanservice.noaa.gov/facts/nuisance-flooding.html
[21] Wahl et al. 2015. Nature. https://www.nature.com/articles/nclimate2736
[22] https://www.des.nh.gov/organization/divisions/water/wmb/coastal/documents/coastal-zone-management.pdf
[23] https://www.des.nh.gov/organization/divisions/water/wmb/coastal/documents/nh_coastal_zone_map.pdf

New Hampshire Coastal Zone Communities (*Source: NHDES)*

Great Bay Municipalities: New Hampshire's Great Bay (tidally-influenced) municipalities include Dover, Durham, Exeter, Greenland, Madbury, Newfields, Newington, Newmarket, Rollinsford, and Stratham. These communities are located in the southeastern corner of the State surrounding Great Bay, which is a nationally recognized Estuarine Research Reserve.

Most of the Great Bay communities lie within the Piscataqua River Basin through which flow a number of coastal rivers, including the Cocheco, Lamprey, Oyster, Exeter, Winnicut, and Salmon Falls. The Salmon Falls River flows south into the Piscataqua River and acts as the boundary between New Hampshire and Maine before draining into the Gulf of Maine through Portsmouth Harbor. Influenced by historic development patterns and significant changes in land use, as well as extreme precipitation and coastal surge, these complex freshwater river systems have experienced more frequent and significant flooding during storm events in the past 12 years. These contributing factors translate into the Great Bay communities being vulnerable to both salt water and freshwater flooding.

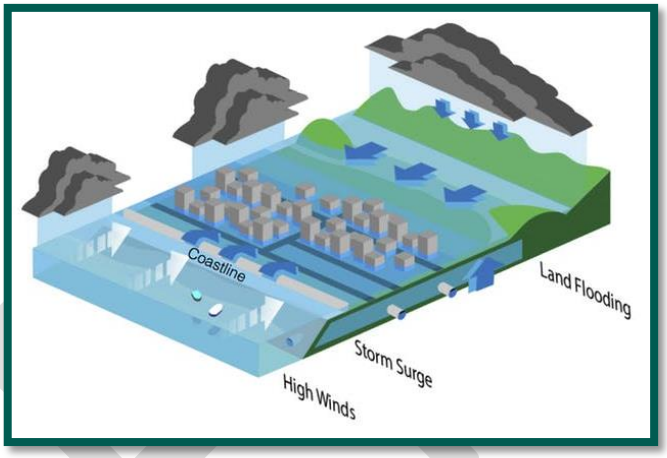
Any other flooding, such as riverine flooding, will be covered in the inland flooding hazard section.

Background and evolving hazard information: The flooding of low-lying areas on the New Hampshire coast is a natural phenomenon and has occurred for centuries. Coastal floods are caused by extreme sea levels, which arise as a combination of four main factors: waves, astronomical tides, storm surges, and relative mean sea level.[24] Rainfall can exacerbate coastal flooding, leading to compounded impacts. New Hampshire experiences coastal flooding from episodic coastal inundation that result from tropical cyclones (hurricanes) and extratropical storms (Nor'easters) and occasional high tides, as well as chronic

[24] https://www.surgewatch.org/what-causes-coastal-flooding/

coastal inundation due to sea-level rise. Select episodic and chronic coastal inundation factors are defined below:

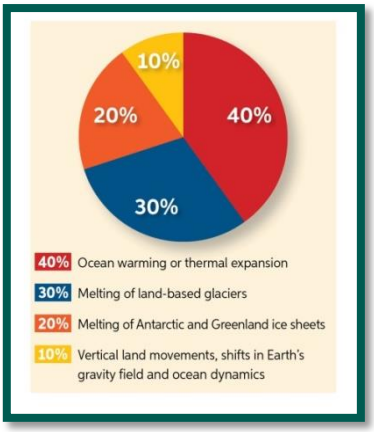
Storm surge: Storm surge is produced by storm winds that drive ocean waters onshore, resulting in a short-term rise in sea level.[25] The abnormal rise in sea level can cause extreme flooding in coastal areas, particularly when storm surge coincides with high tide. Storm surges can be further exacerbated by surface wave action caused by the friction between wind and water.[26] Wave action, in particular, can cause significant damage.



"Understanding compound flooding from land and ocean sources " *(Source: Theodore Scontras, University of Maine)*

Tidal/high-tide/nuisance flooding: High tide flooding, also described as "nuisance", "sunny-day" and "recurrent" flooding, is flooding that leads to public inconveniences, such as road closures. It is increasingly common as coastal sea levels rise and developed areas expand and change drainage patterns in coastal areas. It is often caused by or exacerbated during astronomical spring tides when the gravitational pull of the sun is 'added' to that of the moon, causing high tides to be higher and low tides to be lower than normal. This type of minor flooding often occurs with little or no concurrent storm effects.[27,28]

Compound flooding (i.e., freshwater flooding + storm surge and/or high tide): Compound flooding can occur when storm surge and heavy precipitation happen concurrently. High tidal or surge water levels can impede stormwater draining into the sea, causing flooding inland. High rainfall can add yet more water to an existing tidal flood, as illustrated in the figure below. The risks of flood impacts from compound flooding in low-lying coastal areas is often much greater than from either coastal flooding or inland flooding in isolation.[29]



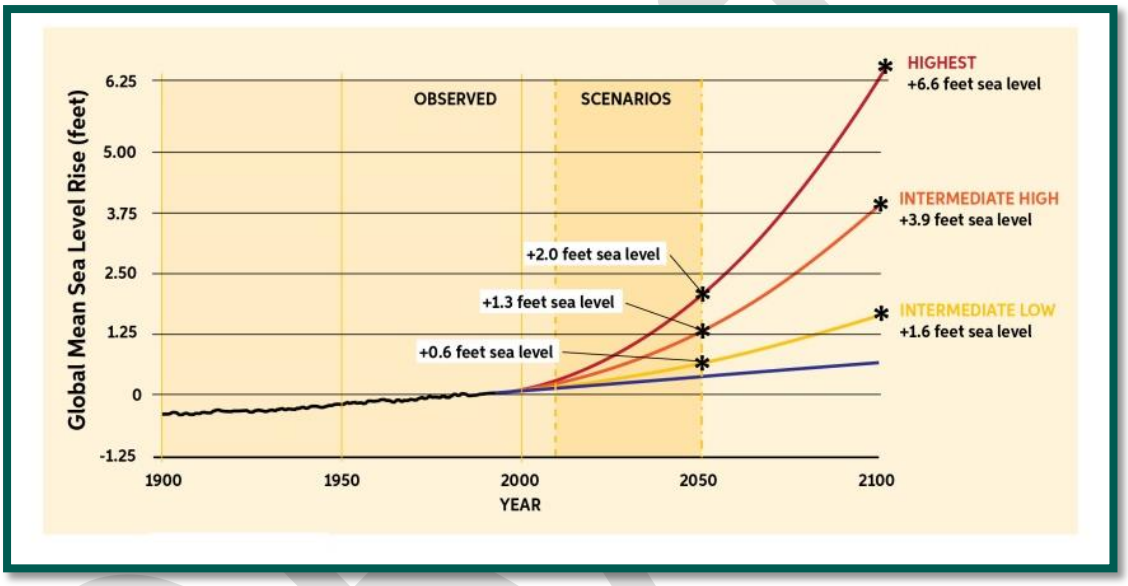
"Processes causing sea levels to rise from 1990-2012" *(Source: NHCRHC)*

Sea-level rise: Global mean sea levels rose 0.7 inches per decade between 1900 and 1993. In 1993, the sea-level rise rate increased to 1.3 inches per decade. Sea levels are expected to continue rising at an accelerating rate well beyond the end of the 21st century due to natural and human-driven changes to the global climate and local landscape. The causes and best available projections for sea-level rise in New

[25] http://www.nhc.noaa.gov/surge/
[26] https://oceanservice.noaa.gov/facts/wavesinocean.html
[27] Sweet and Marra (2016). https://www.ncdc.noaa.gov/monitoring-content/sotc/national/2016/may/sweet-marra-nuisance-flooding-2015.pdf
[28] NOAA. https://oceanservice.noaa.gov/facts/nuisance-flooding.html
[29] Wahl et al. 2015.

Hampshire are shown in the two figures.[30] In 2014, the New Hampshire Coastal Risk and Hazards Commission Science and Technical Advisory Panel (STAP) published a summary of best available science on storm surge, sea-level rise, and extreme precipitation projections.[31] The report states that, using 1992 as a baseline, coastal New Hampshire's sea levels would rise between 0.6 and 2.0 feet by 2050 and between 1.6 and 6.6 feet by 2100.

Groundwater rise: In coastal areas, groundwater flows from recharge areas to discharge areas along the shoreline. As sea-level rises, the groundwater levels near the coast also rise until a new equilibrium is established between aquifer recharge and groundwater discharge to the sea. Modeling shows that groundwater rise driven by sea-level rise may cause flooding in areas where groundwater levels are already high, not only along the coast but also at significant distances inland.[32]



"Sea-level rise scenarios under difference emissions levels in 2050 and 2100" (Source: NHCRHC)

Human activities, such as disruption of natural protective coastal features (dunes, wetlands, etc.) and the lowering of land to create better drainage, have aggravated the coastal flooding hazard in some areas. Roads directly parallel to the coastline, such as New Hampshire Route 1A, are prone to splashover when storms combined with high tide, which can compromise transportation routes. Further, roads that cross tidal marshes can be flooded under similar circumstances, creating potential impacts to egress, in the event of the need to evacuate. This problem is often exacerbated by undersized culvert infrastructure that is inadequate to adequately pass storm flows.

[30] NHCRHC. 2016. http://www.nhcrhc.org/final-report/
[31] STAP. 2014. http://www.nhcrhc.org/stap-report/
[32] Knott et al. 2016. Assessing the Effects of Rising Groundwater from Sea-level Rise on the Service Life of Pavements in Coastal Road Infrastructure. Transportation Research Board. http://docs.trb.org/prp/17-05250.pdf

New Hampshire has a Coastal Adaptation Workgroup (CAW) is a collaboration of 22 organizations that work to assist communities located in the coastal watershed to prepare for coastal flooding, extreme weather, and climate change. CAW provides resources, guidance, and facilitation to enhance readiness and resilience.

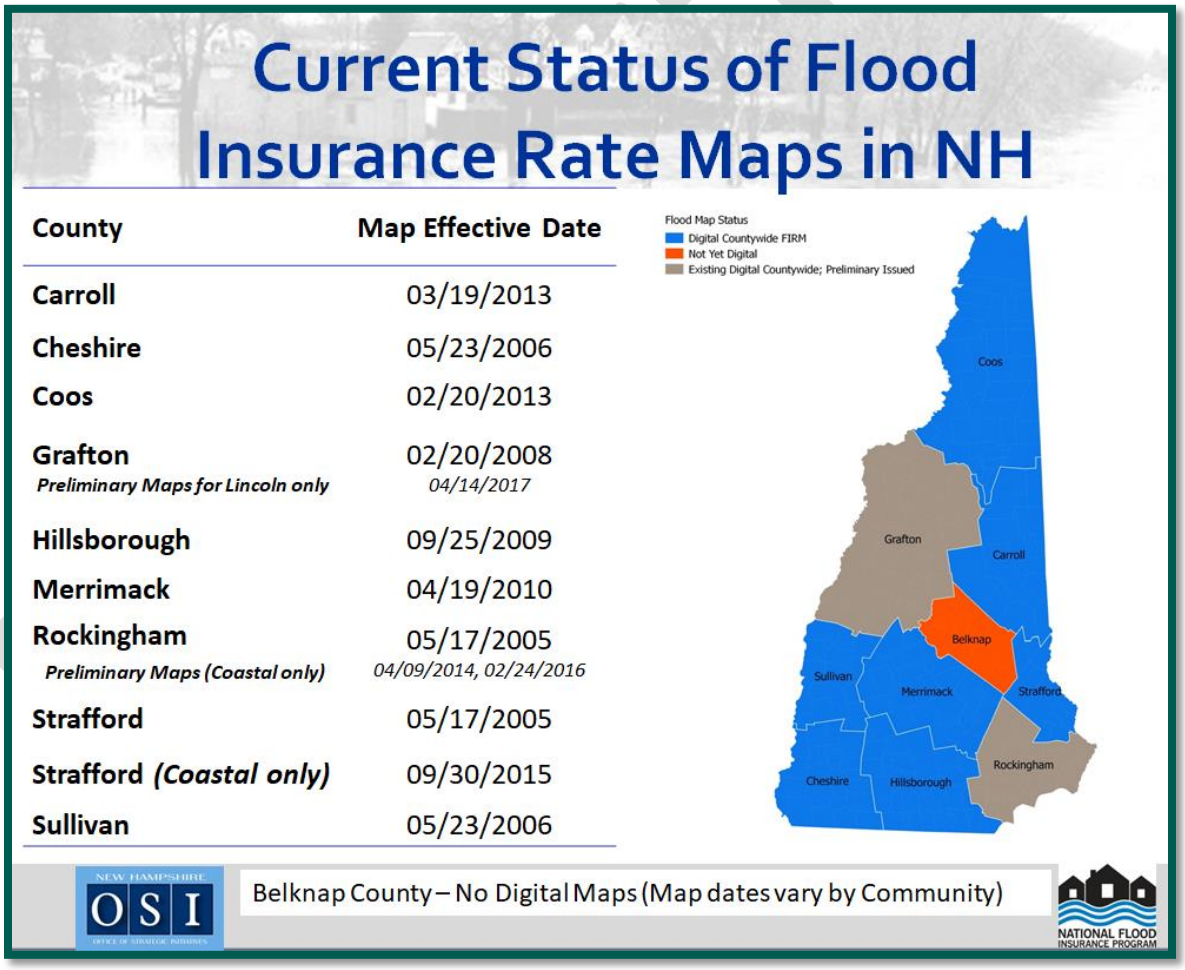
Several streets around Hampton Beach were flooded in January 2014 as the result of a two-day Nor'easter.
(Source - John Kane/Hampton Beach Village district)

A state-of-the-art tide gauge is installed at the Hampton Fire Rescue Pier on Hampton Harbor by scientists from UMASS Boston, center for Coastal Environmental Sensing Networks (CESN)
(Source - Coastal Adaption Workgroup [CAW])

In September 2011, the New Hampshire Piscataqua/Salmon Falls Basin Coastal Project was kicked off for community officials and interested parties at a meeting at the University of New Hampshire. The Coastal Project is being conducted by the University of New Hampshire, in partnership with the NH OSI, the U.S. Geological Survey New Hampshire/Vermont Water Resources Center, and AECOM (a private sector engineering company). A primary goal of the effort is to produce new FEMA Digital Flood Insurance Rate Maps (DFIRM) for 17 coastal communities located in Rockingham and Strafford counties.

[33] Jason Schreiber Union Leader Article Coastal Flooding Forces Road Closures January 2014

As part of this coastal mapping project, updated coastal analyses and mapping of the 0.1% annual chance floodplains were performed to better represent flood risks in coastal municipalities. The updated maps incorporate higher resolution LiDAR data and a new coastal flood hazard mapping methodology that includes storm surge and wave run-up analyses. FEMA finalized the updated coastal maps for communities in Strafford County in 2015. The preliminary maps for communities in Rockingham County are now in the process of being finalized.[34][35] The figure below shows the status of the FIRMS maps in New Hampshire as of May of 2018. Effective FEMA FIRMs for Strafford and Rockingham Counties can be viewed and downloaded in several places including, but not limited to, the FEMA Flood Map Service Center (https://msc.fema.gov/portal), the University of New Hampshire GRANIT data portal (http://www.granit.unh.edu/data), and the New Hampshire Coastal Viewer (http://www.nhcoastalviewer.org/).



Current status of New Hampshire County Flood Insurance Rate Maps (FIRMS) as of May 2018.
(Source – NHOSI and NFIP)

[34] Office of Strategic Initiatives. 2014. Coastal Mapping Project. https://www.nh.gov/osi/planning/programs/fmp/coastal-mapping-project/
[35] https://www.fema.gov/coastal-flood-risk-mapping-process#

Extent:

The depth of a coastal flood event is determined by a combination of several factors such as storm intensity, forward speed, storm area size, coastline characteristics, and angle of approach to the coast, and tide height. Severity can vary significantly based on both speed of onset (how quickly the floodwaters rise) and the flood event duration. Nor'easters can impact the region for several days and produce a storm surge with or without the addition of inland runoff from heavy precipitation.

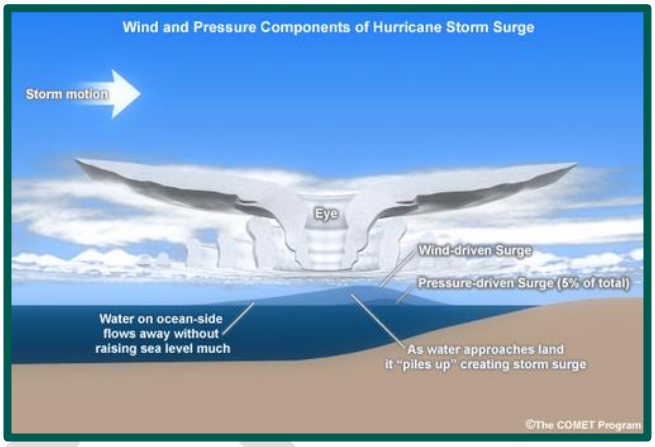


Diagram of a hurricane and associate storm surge causes.
(Source – COMET MetEd Program, NOAA)

Storm events along the coast, such as tropical cyclones and Nor'easters, create storm surge which poses the greatest threat to life and property. Storm surge occurs when water is pushed onshore by the force of winds of a storm moving onshore, with the most severe storm surge occurring when the winds blow onshore perpendicular to the angle of the beach. Storm surge is very complex and challenging to forecast, as any slight change in storm intensity, movement, speed, size, angle of approach to the coast, and central pressure can affect the severity of the surge along the coast. .[36]

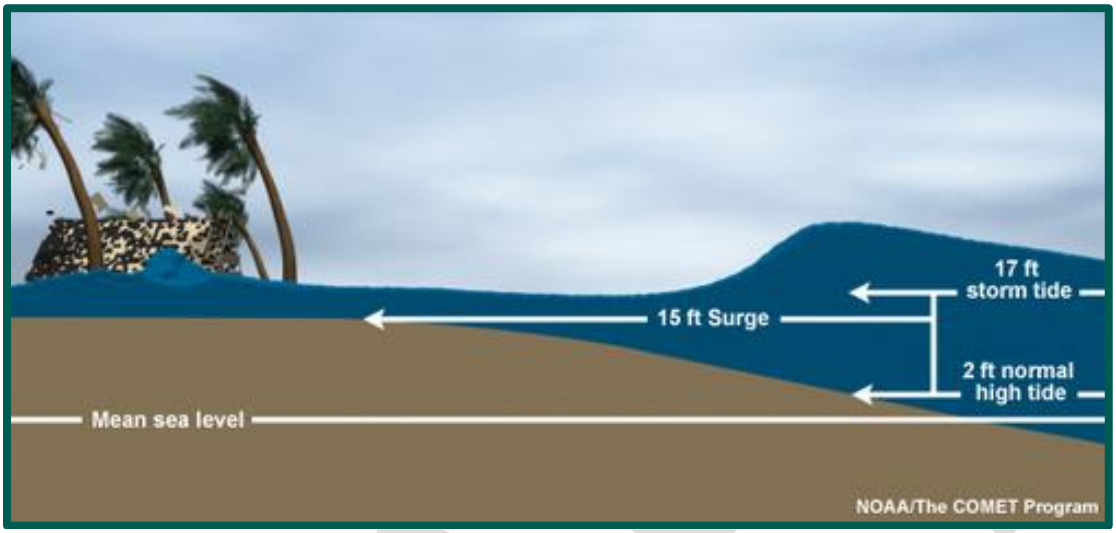
Where tidal gauges are present, the magnitude of flooding is ranked and area specific forecasts are created using a flood scale that ranges from the Action Stage to Major Flood Stage. The National Weather Service characterizes flood severity to more effectively communicate the impact of flooding as follows[3738]:

- Action Stage – Water source is rising and actions must be taken in preparation of potential signification hydrologic activity. There are no impacts at this stage.
- Minor Flood Stage – Minimal or no property damage, but possibly some public threat (e.g., inundation of roads)
- Moderate Flooding – Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations
- Major Flooding – Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

There are two tidal gauges that have been placed along the coastline of New Hampshire to enhance flood forecasts and monitor the severity and frequency of coastal flooding. These tidal gauges are located at Hampton Harbor and Fort Point, and are maintained by the Northeast Regional Association of Coastal Ocean Observing Systems (NERACOOS) and National Oceanic and Atmospheric Administration's National Ocean Service (NOAA NOS), respectively. The impacts of floods vary locally. For each NWS forecast location, flood stages associated with each of the NWS flood severity categories are established

[36,9] http://www.nhc.noaa.gov/surge/
[37] National Weather Service Manual 10-950 (2017), Definitions and General Terminology: http://www.nws.noaa.gov/directives/sym/pd01009050curr.pdf
[38] https://www.weather.gov/aprfc/terminology

in cooperation with local officials. The flood stage for minor flooding at the Fort Point, New Hampshire tide gauge is 11.5 feet while the minor flood stage at the Hampton, New Hampshire tide gauge is 11.0 feet above Mean Lower Low Water (MLLW).



"Combining high tide and storm surge to understand the storm tide" *(Source: NOAA)*

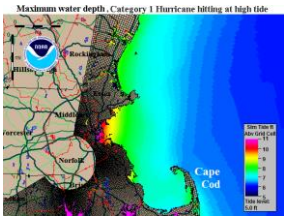
Storm surge is an abnormal rise of water generated by a storm, which is over and above the predicted astronomical tides. Storm tide differs from storm surge, however, in that storm tide is the water level rise due to the combination of both storm surge and the astronomical tide. Extreme flooding can occur in coastal areas when storm surge coincides with the astronomical high tide.[39]

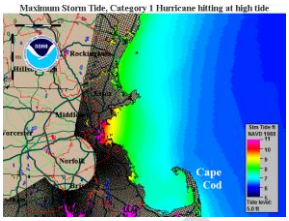
NOAA uses the Sea, Lake, and Overland Surge from Hurricanes (SLOSH) model to generate storm surge predictions using a computer. Meteorologists and emergency management personnel are able to utilize the SLOSH computer model to create storm surge inundation maps that are based on Maximum Envelopes of Water (MEOWs) and the Maximum of MEOWs (MOMs) that take into account different storm intensities to show, approximately, how much flood waters will inundate the land along the coast.[40] This technique is currently regarded as the best approach for determining potential storm surge and is based solely on the direction of motion, forward speed, and intensity of a hypothetical tropical cyclone. It is worth noting here that the scenarios generated by the SLOSH model assume a direct hit by the storm to the modeled location.

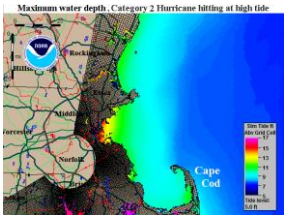
Emergency management officials utilize tools such as SLOSH modeling and HURREVAC, evacuation decision support guidance based on Hurricane Evacuation Studies (HES), and National Hurricane Center (NHC) forecast products to determine the potential impacts of tropical cyclones—namely storm surge—by using real time track information from an incoming tropical cyclone. During incidents, this information can be used to determine which evacuation zones to issue an evacuation order. Before and after incidents, the information contained in historical data can be used to identify previously impacted areas to identify mitigation opportunities based upon previous extent of inundation.

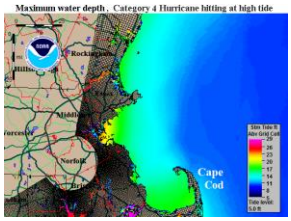
[40] https://www.wunderground.com/hurricane/NewEngSurge.asp

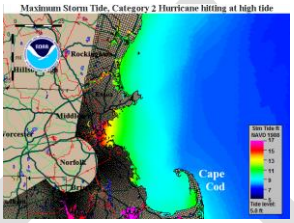
Below are SLOSH models from NOAA for the Northern Massachusetts and New Hampshire Coast for predicted water depths and storm tides for Categories 1-4 Hurricanes (MOM):

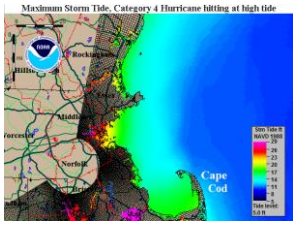


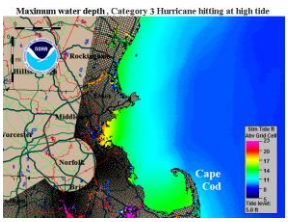


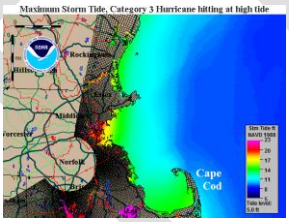


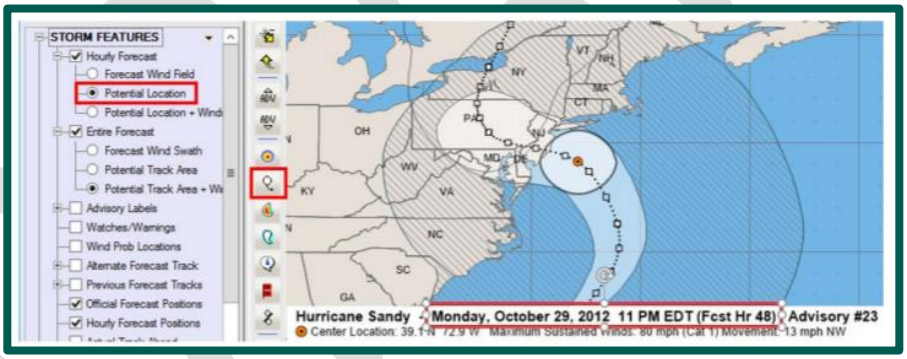












Screenshot from Hurrevac software depicting the storm track of Hurricane Sandy. From the NOAA forecast information, this software can display estimated rainfall amounts and areas, estimated wind amounts and areas, estimated flood surge areas and extent, as well as help plan for time of impacts and evacuations if necessary.

Impacts:

Coastal hazards associated with coastal storms, surge, sea-level rise, and extreme precipitation events can be devastating to human health and safety, public and private structures and facilities, natural resources, and the economies of coastal communities. Coastal New Hampshire was fortunate to experience minimal damage from Tropical Storm Irene in 2011 and Superstorm Sandy in 2012. Nevertheless, the impacts of these storms on neighboring states and the more extreme local impacts from storms such as the Mother's Day storm of 2006, the Patriots' Day storm of 2007, and other historical events have reinforced our knowledge that strong storm systems are capable of causing immense damage in areas on or near the coast. New Hampshire's coastal exposure to current and

future flood risks is significant. As of 2016, the state's 17 coastal municipalities are home to approximately 11 percent of the state population, host over 100,000 jobs, and generated a 2014 Gross Regional Product of approximately $11 billion.

Personal properties (houses, outbuildings, etc.), businesses, industrial complexes, housing units, roads, flood control devices (culverts, etc.), bridges, railroads, power and utility lines, seawalls, and contents of properties are all examples of assets that can be damaged during a coastal flooding event. After the primary damages from coastal flooding have passed, additional damage may occur over time as impacted structures rot and degrade. Coastal flooding events with strong surge and high wave action components not only cause inundation, but are strong enough to physically move large debris, such as boulders and cement seawalls, but also knock homes and other structures off of their foundations.

Coastal flooding can result in a multitude of environmental impacts. Storm-induced high tides can inundate tidal marshes causing damage to the fragile habitat and reducing the high biodiversity typically located there. Extensive coastal flooding also introduces salty seawater into adjacent lands, and can lead to saltwater intrusion into the groundwater table if such flooding occurs to a significant distance inland. Beaches and sand dunes can be extensively eroded during coastal flood events, which can reduce the ability of these features to buffer lands directly inland from the power of the ocean. This is of particular concern when another storm or high tide occurs shortly after to the initially damaging one, exacerbating flooding just inland. An example of this was seen in March of 2018 when back to back coastal storms, the first of which coincided with one of the highest astronomical high tides of the year, significantly damaged the seawall and caused other severe impacts in many coastal towns. These events led to a federally declared disaster for the State.

The National Flood Insurance Program (NFIP) is a regulatory framework that employs floodplain management techniques to identify existing flood vulnerabilities and reduce the negative impacts of flooding on the built environment. All 17 coastal zone municipalities participate in the NFIP, but many communities have only adopted the NFIP minimum standards, which offer structures some protection from flood damage. A few communities have adopted higher standards, including the City of Dover and the Towns of Durham and Rye, which have instituted a 2-foot freeboard requirement, and the Town of Hampton, which has instituted a 1-foot freeboard requirement.

As of February 2018, there were a total of 3,019 NFIP flood insurance policies in effect in New Hampshire's coastal zone with a total insured value of nearly $650 million, which accounts for approximately 35 percent of the State's total amount.[41] Hampton holds 60 percent of those policies followed by Rye with 10 percent and Seabrook Beach Village District with 6 percent. Since 1978, there have been a total of over $10.8 million in NFIP paid losses in the 17 coastal zone municipalities. Hampton has 42 percent of those losses followed by Rye with 16 percent and Exeter with 11 percent.

While these communities are all at risk of coastal flooding, some of the claims data is likely associated with freshwater flooding (referred to as inland flooding in this plan) incidents. It is also important to recognize that not all coastal flood damage is captured by NFIP paid losses data, and, therefore, additional coastal flood damage and associated costs to property not covered by flood insurance or unclaimed under the NFIP were incurred during this period.

[41] New Hampshire Office of State Initiatives. (2018). National Flood Insurance Program data summary.

Coastal flooding is expected to worsen over time due to a combination of rising sea levels that result from a changing climate, a growing population in areas with beaches, and increased development along coastlines. Sea-level rise in tandem with an increase in the intensity and frequency of coastal storms will exacerbate coastal flooding events in the future. In addition, there may be increased vulnerability to flora and fauna; and it is not clear if some of our natural protections (such as salt marshes) will be able to keep up with sea-level rise. Salt marshes and wetlands serve to provide a transition zone between the ocean and dry land. The natural inland migration of these natural protections as a response to sea-level rise are hindered by coastal development, effectively bringing ocean waters closer to developed areas on a more regular basis. More information on potential future impacts of sea-level rise and increased severity and frequency of storm surge events is discussed in the Climate Change Chapter of this plan.

Previous Occurrences:

According to NOAA's Centers for Environmental Information, New Hampshire experienced 46 coastal flood events between 1950 and 2017. While no deaths due to coastal flood events were reported during that period, 37 of the events resulted in property damage.[42]

New Hampshire has a high tidal range that varies at different locations around the coastal zone. At the Fort Point tide gauge, between April 2007 and October 2017, mean high water averaged 9.3 feet above mean lower low water.[43] Between 2013 and 2017, the Fort Point, New Hampshire tide gauge registered 18 events that exceeded the minor flood stage of 11.5 feet. Five notable high tides and dates are listed below for the Fort Point tide gauge referenced to mean lower low water. The Hampton, New Hampshire tide gauge was installed in 2013, and historical data at this site has been recorded since 2018. The highest tide in recent years was recorded by the Hampton Tide gauge at 13.24 feet on January 4, 2018 during winter storm Grayson.

Table: Maximum Tides at Fort Point Tide Gauge since 2007 (Source: NOAA)

Event Month	Fort Point Maximum Tide
January 2010	12.277 ft
January 2014	12.257 ft
April 2007	12.159 ft
June 2012	12.156 ft
May 2017	12.113 ft

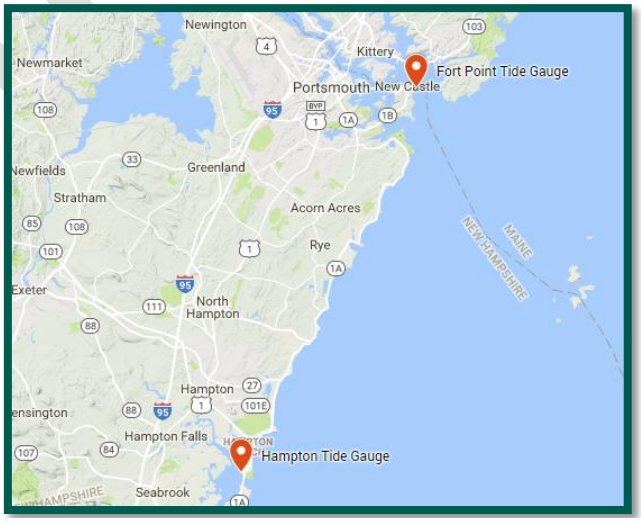


Figure: New Hampshire Tide Gauge Locations *(Source: Google)*

[42] National Centers for Environmental Information Storm Events Database: https://www.ncdc.noaa.gov/stormevents/

[43] https://tidesandcurrents.noaa.gov/stationhome.html?id=8423898

Several coastal storm and flood events that occurred between 1938 and 2018 are described in the table below.[44,45] This table does not capture all major coastal flooding that has occurred in coastal New Hampshire communities. Some instances of coastal flooding by hurricanes are captured in the Tropical and Post-Tropical section of this Plan.

Event Date	Event Description	Impacts	Location	Additional Information
September 1938	Hurricane	Few records of damage exist. Heavy damage along the coast with significant flooding.	Statewide	The flood of September 1938 occurred when a hurricane struck New England after a week of almost continuous rain. The hurricane itself produced another 4-8" of rain in New Hampshire.
December 1959	Nor'easter	Damage was heaviest along the coast.	New Hampshire Coast	A Nor'easter brought tides exceeding maximum tidal flood levels in Portsmouth.
March 1972	Severe Coastal Storm	Damage was extensive along the coast.	New Hampshire Coast	The Coastal Area was declared a National Disaster Area because of the devastating effects of a severe coastal storm.
February 1978	"The Blizzard of '78"	The hardest hit area was the coastline, with wave action and floodwaters destroying homes. Roads all along the coast were breached by waves flooding over to meet the rising tidal waters in the marshes.	Statewide	A Nor'easter brought strong winds and precipitation to the entire State.
December 1986	Storm	Ocean Boulevard closed Route 51 to High St. Flooding on Ashworth Ave. and Brown Ave. in Hampton, NH. Floating pier lost at Portsmouth U.S. Coast Guard Station. Boats sank in Rye Harbor.	New Hampshire Coast	12.75' tide (Portland, ME) with 1.14' of storm surge and 17' waves. Highest water at Hampton Beach in six years.
January 1987	Storm	Several miles of Route 1A from Hampton to Little Boars Rd. closed. Seawall partially collapsed in Rye. Hampton Police Station surrounded by water knee deep.	New Hampshire Coast	13.14' tide (Portland, ME) with 1.79' storm surge and 10'+ waves.
October 1990	Storm	Southern end of Hampton seawall was damaged. Hampton Policy Station and Island Path were flooded with 2' of water.	New Hampshire Coast	13.26' tide (Portland, ME) with 1.64' storm surge and 14' waves.
October 1991	"The Perfect Storm"	Hampton Police and Fire Stations flooded with 2' of water. One house in Seabrook was swept away. Significant damage to Rye Harbor. Street flooding on Route 1A in Rye. $5.6 million in property damage.	New Hampshire Coast	12.73' tide (Portland, ME) with 2.89' storm surge and 28' waves. Tidal surge of approximately 3.5'.

[44] Personal communication with John Cannon, National Weather Service, January 2018
[45] http://www.nws.noaa.gov/floodsafety/states/nh-flood.shtml

Event Date	Event Description	Impacts	Location	Additional Information
December 1992	Storm	Seaweed forced up the filter of the cooling system at the Seabrook Nuclear Power Plant, shutting it down. Waves carried heavy boulders and sand onto roads, over seawalls.	New Hampshire Coast	12.14' tide (Portland, ME) with 1.31' storm surge and 18' waves.
October 1996	Storm	Significant damage was caused along the coast.	New Hampshire Coast	The coastal areas were declared disaster areas after receiving 14 inches of rain. High tides coincided with a 500-year precipitation event.
May 2006	"Mother's Day Flood"	Homes and businesses were damaged extensively, primarily in inland tidal communities. Many roads were washed out and impassible. Some bridges were damaged or destroyed. Several evacuations and rescues took place during the flood event. Two dams on the Salmon Falls River were being monitored because they were at risk for overflowing. Damage costs were $10 million but this is for public damage only. There were no deaths or injuries reported.	New Hampshire Coast	A Nor'easter created flooding through the State.
April 2007	"Patriot's Day Storm"	Statewide public damage costs were $8 million. The beaches, especially North Beach, suffered the worst erosion in decades. Seawalls in Rye were destroyed. Water and waves flooded roads at Hampton Beach. No deaths or injuries were reported.	New Hampshire Coast	A major Nor'easter fueled waves that reached over 30'. Astronomical high tides reached 12.5' at the Fort Point tide gauge (newly installed in 2007) with 2.02' of storm surge. Flooding continued over a three day period.
February and March 2010	Storms	Numerous roads were flooded and culverts were blown-out. Disaster declarations were made for two of the storms.	New Hampshire Coast	The seacoast area received three, 50-year precipitation events in a 35-day period.
October and November 2012	Superstorm Sandy	Flooding occurred in usual areas in Hampton back bay area.	New Hampshire Coast	Tropical storm Sandy reached the NH Seacoast with a moderate astronomical high tide and storm surge of approximately 2'. Seas eventually reached 20' in height with wave action.

Event Date	Event Description	Impacts	Location	Additional Information
January 2018	Grayson	Hampton Policy and Fire Station parking area was flooded and inaccessible for 90 minutes. Fire Department completed several rescues. Fire trucks were damaged by salt water. Damage to homes and vehicles was reported in Hampton. Route 1A was closed briefly through Rye. Mechanic St. in Portsmouth was also closed due to flooding.	New Hampshire Coast	Nor'easter snowstorm occurred during a 10.5' tide with an additional 2.74' of storm surge, reaching 13.24' at the Hampton tide gauge.
March 2018	Sequential Coastal Storms	Rockingham County sustained widespread damages to State and local infrastructure, including seawall damage in four communities.	New Hampshire Coast	A combination of high tide levels and large waves caused by the storm resulted in severe damage to route 1A, the temporary closure of three dozen roadways due to debris, and significant damage to three miles of shale seawall.

Inland Flooding

HIRA Risk: High
Future Probability: High
Counties at Risk: All

Definition:
Inland flooding is generally defined as a high flow, overflow, or inundation by water, which causes or threatens damage.[46] Flooding results from the overflow of rivers, their tributaries, and streams throughout the State, primarily from high precipitation events. Flash flooding is defined as a flow with a rapid rise in water level and extreme velocities in a river or stream, beginning within six hours of the causative event (e.g., intense rainfall, dam failure, ice jam). Ongoing flooding can intensify to flash flooding in cases where intense rainfall results in a rapid surge of rising flood waters.[52] Because of New Hampshire's steep terrain in the headwaters of watersheds, particularly outside of the coastal plain, flash floods also lead to river bank and bed erosion. Extreme precipitation events in recent years, such as Tropical Storm Irene, have led to buildings on the edges of streambanks becoming at risk to river erosion, or culvert failures.

The National Flood Insurance Program (NFIP) has a more specific definition of flooding, which can also be considered and used when looking at floodplain and floodplain mapping. A flood is defined by the NFIP as[47]:

- A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from:
  - Overflow of inland or tidal waters
  - Unusual and rapid accumulation or runoff of surface waters from any source
  - Mudflow
- Collapse or subsidence of land along the shore of a lake or similar body of water as a result of erosion or undermining caused by waves or currents of water exceeding anticipated cyclical levels that result in a flood as defined above.

Location:
All counties of New Hampshire have areas which are at risk for flooding.

New Hampshire has more than 34,000 miles of rivers and streams. Communities developed and encroached into the floodplains and along waterways which provided mills with power and transportation. Because of this development pattern, the floodplains of the State were rapidly settled. The shift to industrialization during the mid-nineteenth century compounded the problem with residents moving to the floodplains of the cities and larger villages. Floodplains are extensions of the watercourses and have evolved to carry excessive runoff naturally.

Riverine flooding is the most common disaster event in the State of New Hampshire. Areas that have been identified as part of the0.1% annual chance floodplain in support of the National Flood Insurance Program simply represent those areas for which mapping has been performed. With sufficient rainfall,

[46] http://w1.weather.gov/glossary/index.php?letter=f
[47] https://www.fema.gov/national-flood-insurance-program/definitions

snowmelt, or through the result of ice jam formation or in the event of dam failure, all areas that are floodplain adjacent to rivers and streams in New Hampshire are prone to flood inundation. Locations within floodplains downstream of large dams are susceptible to flood and erosion damage in the event of dam failure. The Dam Bureau at New Hampshire Department of Environmental Services (NHDES) can provide information regarding areas at risk to flood inundation downstream of state owned dams. The United States Army Corps of Engineers is also responsible for six recreation and flood-risk management dams in New Hampshire. These include:

- Blackwater Dam (Webster)
- Edward MacDowell Lake (Peterborough)
- Hopkinton-Everett Lakes (Contoocook)
- Franklin Falls Dam (Franklin)
- Otter Brook Lake (Keene-Roxbury)
- Surry Mountain Lake (Surry)

The United States Army Corps of Engineers has information with regard to inundation areas downstream of these dams. The State of New Hampshire is in possession of the emergency management plans for two of these dams: the Otter Brook Lake and Surry Mountain Lake Dams.

Urban areas within New Hampshire are susceptible to poor drainage flooding during episodes of heavy rain that falls within a short duration. Such flooding is the result of the concentration of impervious surfaces where the amount of concrete, asphalt, rooftops, and other minimally or non-porous materials concentrates flow to urban stormwater systems that, during heavy rain, cannot always handle the input, causing flooding conditions on streets and parking lots.

Outside of the coastal plain of New Hampshire, the headwaters of streams in watersheds are contained within narrow valleys in steep terrain. Stream channels in such physiographic conditions can reach capacity very quickly, and with minimal floodplain available for water to spread and dissipate flow energy, heavy precipitation events can lead to high velocity water moving downstream given the steep terrain, creating situations of not only inundation, but river bed and bank erosion and culvert failures. Examples of this in recent years have included locations in the Keene area in 2013 and 2014, and in Grafton County in July 2017. In the White Mountains, larger rivers can also be susceptible to bank erosion and river channel migration given the steeper gradients located there, combined with the historically straightened nature of many rivers. Recent examples include rivers such as the Baker River in Warren, the East Branch Pemigewasset River in Lincoln or the Peabody River in Gorham.

Given its cold climate, New Hampshire rivers are also prone to ice jams. The State is currently engaged, in 2017, with a Silver Jackets project to examine ways to better predict the location of ice jam formation, given events on the Gale River at Sugar Hill (2011 and prior) and Franconia (2016). The ability to predict the locations of ice jam formation, and therefore, locations of inundation upstream of them is a science still in its infancy. However, one factor in the location of ice jam formation is river channel morphology, particularly locations where a river channel narrows, has constrictions caused by sharp meandering, has shallow reaches with bottom bars, and the locations of stream channel confluences.[48] There are other meteorological factors (i.e., preceding air and water temperature regime) that influence formation.

[48] https://www.nat-hazards-earth-syst-sci.net/17/1033/2017/

From a geomorphological perspective, locations in New Hampshire where the above factors are most likely to occur together are in steeper terrain outside of the coastal plain.

Background and evolving hazard information:

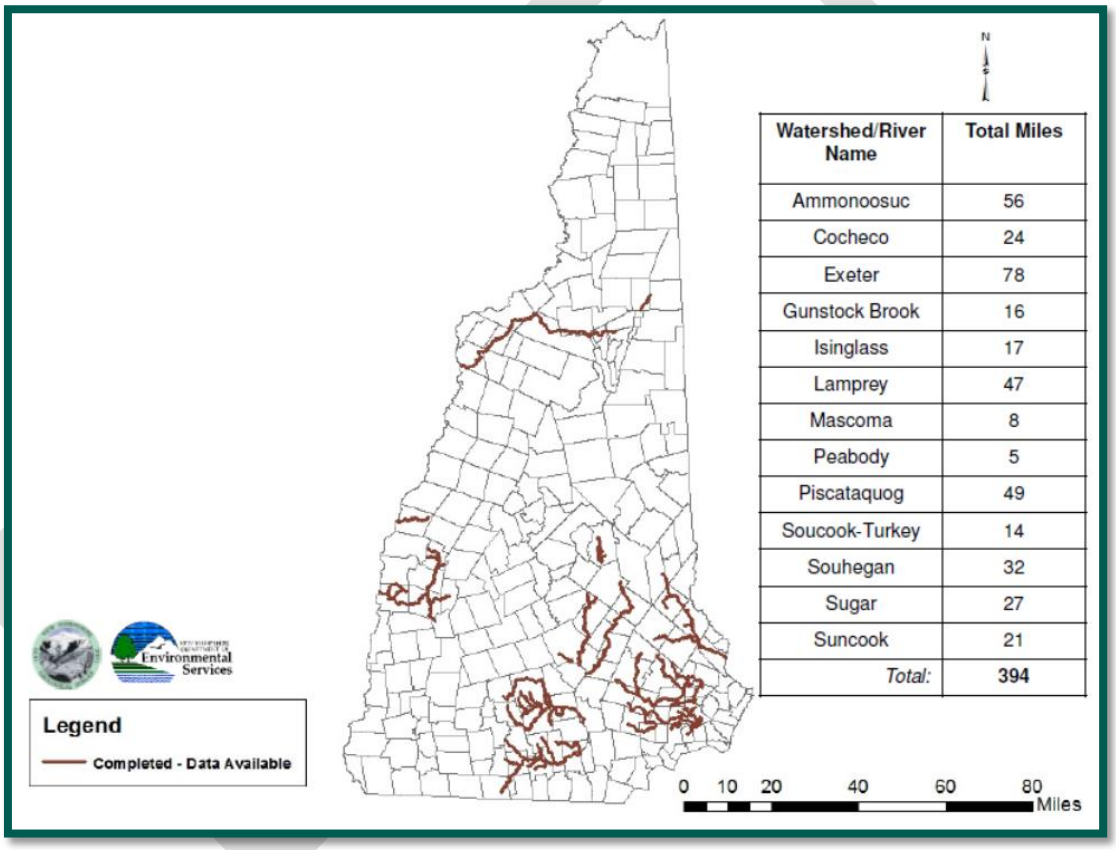
New Hampshire has experienced several significant flood events since 2006 that have washed out culverts, undermined bridges and roads, and washed away streambanks. Such events have occurred within an overall trend of an increasing frequency and intensity of flood events during the past few decades. More recent events have included the Mother's Day flood (2006), additional statewide flooding in 2007, Tropical Storm Irene (2011), thunderstorm induced flash flooding in the Connecticut River Valley (2013 and 2014), and most recently, thunderstorm induced flash flooding in Grafton County (2017). Since that time, multiple agencies in the State of New Hampshire have developed programs, plans and procedures to better respond to, and mitigate, flood risks. While considerable background on the locations and mechanisms that can cause flooding in New Hampshire are described in the preceding "Location" section, the State has taken actions to work toward the long-term goal of flood risk reduction in flood-prone areas, as a result of the effects of the flood events in the mid-2000s. These include:

- Established a statewide state-federal interagency flood risk management team (Silver Jackets), comprised of 14 state and federal agencies to increase communication in support of the mitigation of, and recovery from, flood events in the state.
- Incorporated updated rainfall-runoff values into Alteration of Terrain permitting within NHDES.
- Established a statewide multi-agency stream crossing assessment program and database to identify culverts at risk for failure during flood events, a collaborative effort between NHDES, NH HSEM, NHDOT and New Hampshire Fish & Game.
- Development of hydraulic modeling expertise within NHDES, utilizing new and existing staff, to support greater identification of areas most prone to flooding, utilizing enhanced elevation datasets available.
- Created authorization for stormwater utilities to be formed in state statute.
- Established a conversation among multiple agency partners in 2016-2017 regarding ice jams.
- Collection of statewide LiDAR data (enhanced elevation information) necessary for accurate flood mapping is nearing completion.
- Finalizing the establishment of a statewide flood hazard geodatabase in support of flood mitigation and emergency response functions.
- NHDES' Wastewater Engineering Bureau has increased work with wastewater treatment facilities to assign flood risk ratings and reduce facility vulnerabilities to flooding.

These actions all can work to reduce the risks to citizens during flood events, through enhanced planning using sound data and science that provides State agencies and town officials with up-to-date information. However, these actions cannot stop flooding, given that every New Hampshire river can and does flood. Properties and infrastructure adjacent to rivers and streams will continue to be prone to inundation risks. Locations downstream of dams are still at risk of flooding and erosion should dams breach or fail. Rivers and streams will still be prone to erosion and migration, impacting adjacent infrastructure and altering the landscape, particularly in steeper terrain and during active flood events. State agencies will continue to work collaboratively to utilize the latest information and knowledge of flood locations to prioritize the reduction of flood risk now and into the future.

Riverine Erosion, Scouring, and Flooding

River erosion is a recurrent problem in New Hampshire, especially with those rivers and streams within watersheds that have steep terrain, where rivers have been historically straightening and modified, and that have development adjacent to them. Local scale erosion, or scouring, also occurs throughout the State, particularly in the vicinity of bridge and culverts (particularly downstream of them) and other structures within rivers, such as retaining walls and riprap revetment, particularly if such structures are not properly placed upon their original installation. As described in previous sections, bed and bank erosion has been a particular problem in the "flashy" streams of northern and western New Hampshire, away from the coastal plain. Most recently, severe bank erosion occurred on rivers and streams in the White Mountains as a result of Tropical Storm Irene, and from thunderstorm-induced heavy rain in western New Hampshire in 2013 and 2014. From these events, homes, businesses and infrastructure were impacted, demonstrating that extreme rain events of that magnitude can lead to widespread river erosion and river channel changes throughout one or more regions of the State, depending upon the spatial extent of the event.



Watershed/River Name	Total Miles
Ammonoosuc	56
Cocheco	24
Exeter	78
Gunstock Brook	16
Isinglass	17
Lamprey	47
Mascoma	8
Peabody	5
Piscataquog	49
Soucook-Turkey	14
Souhegan	32
Sugar	27
Suncook	21
Total:	**394**

Locations of fluvial geomorphology data on New Hampshire rivers and streams that is available.
(Source-NHDES)

The most dramatic kind of erosion event, known as an "avulsion," occurs when a river cuts through one of its banks and creates and entirely new path, usually abandoning its old channel in the process. A large-scale event in New Hampshire of this type occurred on the Suncook River in Epsom in 2006, when a new channel was created through an old glacial wetland in the vicinity of an abandoned gravel operation, shortening its path by about ¼ mile. A smaller-scale example occurred in 2013 in Surry when

a short reach of Merriam Brook became filled with rock from upstream, forcing the high flow to cut a new channel across a homeowner's lawn (Figure Y).

Prior to 2015, the New Hampshire Geological Survey oversaw the collection of fluvial geomorphology data on 394 miles of New Hampshire's rivers and streams, as shown in Figure X. Information collected included the identification of river reaches that have been straightened, and locations of riprap revetment and retaining walls. The existence of river straightening suggests that channel erosion and migration could occur in such locations at a later time given that river channels will naturally seek to recreate meanders for themselves. The presence of riprap or revetment is typically indicative of a pre-existing erosion problem.

Of the 394 miles of streams for which this type of data has been collected in New Hampshire, 72.5 miles have been identified as having been straightened. This constitutes 18% of the assessed rivers. These 394 miles of streams all have two banks, or sides of the channel, encompassing a total of 788 miles of streambank. Of this total, 53.5 miles, or 6.8% of the total length of streambank for which data is available has either had riprap or bank revetment installed. Similarly, 81 miles of streambank, or 10% of the total assessed, were noted as experiencing bank erosion to an extent beyond what is normal background erosion in rivers. While this data is not available for all New Hampshire rivers, these figures provide one quantitative measure of the extent of the concern and potential risks, at least from those rivers that have been so assessed.

Merriam Brook in Surry on July 31, 2013. The original channel (to the right) filled in with rock transported from upstream, forcing the channel to break through the bank, cutting a new channel for itself at the southern end of the homeowner's lawn (to the left). *(Source-NHDES)*

Rapid Snowmelt

The State's climate and mountainous terrain increases the susceptibility to flooding as a result of the seasonal melting of the snowpack. In particular, a warm and/or rainy spring can exacerbate this risk as the snow melts faster than it can be absorbed into the groundwater or evaporated. The snowmelt can also flow overland into receiving streams and rivers, causing them to rapidly rise, and in some cases,

overflow their banks.[49] Streams, especially those located in the headwaters and watersheds, may experience erosion and scour. Sediment that is eroded and scoured from stream beds and banks can then be deposited at locations where the stream flow decreases, or upstream of undersized culverts, enhancing future flood risks. The more level terrain of New Hampshire, particularly the coastal plain, may experience inundation that is accelerated by the rapid melting of the snowpack.

Ice Jam Flooding

A backup of water into areas adjacent floodplain can occur when a river or stream is blocked by the build-up of ice[54]. Ice in waterways forms naturally from the freezing of water during the winter months. Melt and/or storm water may then encounter these ice formations causing them to break up and move down the river. Ice may apply lateral and/or vertical force on structures and infrastructure. Moving ice may scour abutments and riverbanks, and ice may also create temporary dams. These dams may create flood hazard conditions where no flood hazard previously existed, as experienced in February 2016 on the Gale River at Plantation Road in Franconia. It is becoming understood that river geomorphology also can influence ice jam formation, and this has been discussed previously in the "Location" section.

Ice jam on the Pemigewasset River at Holderness caused flooding in Holderness and the Plymouth State University parking lot where parked cars became submerged.
(Source: Siobhan Lopez, WMUR)

New Hampshire's exposure to this hazard type has prompted several interventions by the U.S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory (CREEL). The Corps has constructed dams and ice diversion structures to arrest the flow of large, potentially damaging ice formations to reduce flooding potential and the possible impact by ice on bridges, streambanks, and other structures. Other techniques to reduce flood potential due to ice jams include excavation, mechanical breaking, ice blasting, over-spraying an area with ash or leaf mulch to accelerate melting, planned releases of relatively warmer water from impoundments, and the installation of electronic devices to signal ice moment which might aid in evacuations and other response measures. While these are technical measures to address and deal with ice jams once they form, because of the uncertainty in prediction of where ice jams will form, it is important for town officials and citizens to learn the signs of formation, and know the steps to take from an emergency response perspective upon the formation of an ice jam near individuals and infrastructure.

Extent:

Where river gauges are present, the magnitude of flooding is ranked and area specific forecasts are created using a flood scale that ranges from the Action Stage to Major Flood Stage. The National Weather Service characterizes flood severity to more effectively communicate the impact of flooding as follows[5051]:

[49] http://www.floodsafety.noaa.gov/states/nh-flood.shtml
[50] National Weather Service Manual 10-950 (2017), Definitions and General Terminology: http://www.nws.noaa.gov/directives/sym/pd01009050curr.pdf
[51] https://www.weather.gov/aprfc/terminology

- Action Stage – Water source is rising and actions must be taken in preparation of potential signification hydrologic activity. There are no impacts at this stage.
- Minor Flood Stage – Minimal or no property damage, but possibly some public threat (e.g., inundation of roads)
- Moderate Flooding – Some inundation of structures and roads near streams. Some evacuations of people and/or transfer of property to higher elevations
- Major Flooding – Extensive inundation of structures and roads. Significant evacuations of people and/or transfer of property to higher elevations.

Areas that are not monitored by river gauges are not forecasted or measured using a specific scale; therefore, the best way to describe the extent of the hazard of flooding is its speed of onset (how quickly the floodwaters rise) and its duration (how long the area remains inundated with flood waters). Floods can happen slowly over time during a long duration event or they can happen very rapidly (flash flooding). The speed of onset and duration of an inland flooding event is influenced by the size of the channel and contributing watershed area, terrain of the contributing watershed area, intensity and duration of the rainfall or snowmelt, recent rainfall history, and other factors.

Flash flooding can be caused by heavy rain, ice jams, or levee or dam failure. These floods exhibit a rapid rise of water in stream channels that quickly overtops their banks. In some cases, flooding may occur well away from where the heavy rain initially fell. There are many reasons that flash floods occur, but one of the most common cause in New Hampshire results from the copious amounts of rainfall from thunderstorms. This can also occur when slow-moving or multiple thunderstorms (training thunderstorms) move over the same area. These sudden downpours can rapidly change the water levels in a stream and turn small waterways into violent, raging rivers. Urban areas are also at risk for flash flooding due to the amount of impervious surfaces.

The Federal Insurance and Mitigation Administration (FIMA) has oversight over the National Flood Insurance Program (NFIP)[52]. As part of the NFIP, Digital Flood Insurance Rate Maps (DFIRMs) have been developed to show Special Flood Hazard Areas (SFHAs), on rivers that have been so mapped, which are areas that are at risk for inundation, based on the delineation of the 0.1% annual chance and 0.2% annual chance (500-year) floodplain extents. The SFHA is where the NFIP's floodplain management regulations must be enforced and the area where the mandatory purchase of flood insurance applies. These zones delineate that extent of the 0.1% annual chance flood event. A 0.1% annual chance flood event does not mean that a flood will occur once in a 100-year period. In the 1960s, the 1-percent annual exceedance probability (AEP) flood was selected as the basis for the NFIP. The 0.1% AEP was thought be a fair balance between public safety and overly stringent regulations. As a 0.1% AEP flood has a 1 in 100 probability of being equaled or exceeded in any 1 year – it earned the nickname "100-year" flood as extrapolated the AEP has an average recurrence interval of 100 years, but again does not mean that a flood of the AEP magnitude will only occur once every 100 years. Larger events, such as the "500-year" flood corresponds with a 0.2% AEP. (1 in 500 chance).[53]

Flood Zones are areas that FEMA has defined according to varying levels of flood risk and are displayed on a DFIRM.

[52] https://www.fema.gov/what-mitigation/federal-insurance-mitigation-administration
[53] https://water.usgs.gov/edu/100yearflood-basic.html

Moderate to Low Risk:

Zone	Description
B and X (Shaded)	Area of moderate flood hazard, usually the area between the limits of the 0.1% annual chance and 0.2% annual chance floods, and areas protected by a FEMA-accredited levee as shown on the FIRM. B Zones are used to designate base floodplains of lesser hazards, such as areas protected by levees from 0.1% annual chance flood, or shallow flooding areas with average depths of less than one foot or drainage areas less than 1 square mile.
C and X (Unshaded)	Area of minimal flood hazard, usually depicted on FIRMs as above the 0.2% annual chance flood level. Zone C may have ponding and local drainage problems that do not warrant a detailed study or designation as a base floodplain. Zone X is the area determined to be outside the 0.2% annual chance flood.

High Risk Areas

Zone	Description
A	An area inundated by 0.1% annual chance flooding, for which no Base Flood Elevations (BFEs) have been determined. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AE	An area inundated by 0.1% annual chance flooding, for which BFEs have been determined. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AH	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.
A1-30	Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. Base Flood Elevations (BFEs) are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
AO	Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply. Some Zone AO have been designated in areas with high flood velocities such as alluvial fans and washes. Communities are encouraged to adopt more restrictive requirements for these areas.
AR	Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection. Mandatory flood insurance purchase requirements and floodplain management standards apply.
A99	Areas with a 0.1% annual chance of flooding that will be protected by a Federal flood control system where construction has reached specified legal requirements. No depths or BFEs are show within these zones.
Coastal A Zone	An area inundated by 0.1% annual chance flooding, for which BFEs have been determined and where the flood elevation includes the effects of waves between 1.5 and 3 feet in height. Mandatory flood insurance purchase requirements and floodplain management standards apply.
V	Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.
VE, V1-30	Areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. Base Flood Elevations (BFEs) derived from detailed hydraulic analyses are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Impacts:

Flooding impacts can result in damages to life, property, and the environment. During a flood, flood waters can present a severe threat to people, pets, and wild animals through the risk of drowning, becoming trapped, or by emergency services not being able to rescue people in distress. After a flood, if properties are not properly cleaned, mold and other bacteria can linger in areas that were flooded causing health problems for the people, pets, and wild animals that re-inhabit the area. Personal properties (houses, outbuildings, etc.), businesses, industrial complexes, housing units, roads, stormwater infrastructure, bridges, and culverts, railroads, power and utility lines, and contents of properties are several examples of assets that can be damaged during a flooding event. Even after the main flood has passed, effects can persist and continue to worsen over time from rotting and degradation of structures.

The environment can also be affected during floods. For example, hazardous materials, chemicals and pesticides can be released into flood waters, contaminating those waters. Storm drainage systems in urban areas can be overwhelmed, reducing the ability of wastewater treatment facilities to process waste as efficiently as normal, which could lead to downstream water quality impacts. Flooding kills animals, and can introduce flora, fauna, insects and other organisms to ecosystems in which they are not typically found, distorting the natural balance of the existing ecology. Additionally, contaminants introduced into floodwaters can be introduced to the ecosystem, causing long-term impacts on organisms.

Flooding also has a significant economic impact immediately after the event (with the damage done), directly following the event (loss of commerce due to business closure or inaccessibility), and long after the event (rebuilding and mitigating).

Previous Occurrences[54][55][56]:

Event Date	Recurrence Interval	Impacts	Location	Additional Information
December 1740	Unknown	Unknown	Merrimack River	First Recorded Flood in New Hampshire
10/24/1785	Unknown	Unknown	Cocheco, Baker, Pemigewasset, Contoocook, and Merrimack Rivers.	Greatest Discharge at Merrimack and at Lowell, Mass., through 1902
03/24-30/1785	Unknown	Unknown	Pemigewasset, Merrimack, Contoocook, Blackwater, and Ashuelot Rivers.	Merrimack, highest stream stage since 1785: Contoocook, one of five highest stages.
04/21-24/1852	Unknown	Unknown	Pemigewasset, Winnipesaukee, Contoocook, Merrimack, and Connecticut Rivers.	Merrimack River at Concord, highest stream stage for 70 years; Merrimack River at Nashua, 2 feet lower than in 1785.
04/19-22/1862	Unknown	Unknown	Contoocook, Merrimack, Piscataquog, and Connecticut Rivers.	Highest stream stages to date on Connecticut River. Due solely to snowmelt.

[54] https://www.fema.gov/disaster/
[55] https://md.water.usgs.gov/publications/wsp-2375/nh/
[56] http://www.nhflooded.org/flood_history.php

Event Date	Recurrence Interval	Impacts	Location	Additional Information
10/3-5/1869	Unknown	Unknown	Androscoggin, Pemigewasset, Baker, Contoocook, Merrimack, Piscataquog, Souhegan, Ammonoosuc, Mascoma, and Connecticut Rivers.	Tropical storm lasting 36 hours. Rainfall, 6-12 inches.
11/3-4/1927	25 to >50	Unknown	Pemigewasset, Baker, Merrimack, Ammonoosuc, and Connecticut Rivers.	Upper Pemigewasset River and Baker River; exceeded 1936 flood. Downstream at Plymouth, less severe than 1936 flood.
03/11-21/1936	25 to >50	Unknown	Statewide	Double flood: first, due to rains and snowmelt; second, due to large rainfall.
09/21/1938	25 to >50	Unknown	Contoocook, western tributaries to Merrimack, and south-western New Hampshire tributaries to Connecticut River	Hurricane. Stream stages similar to those of March 1936 and exceeded 1936 stages in upper Contoocook River.
June 1942	Unknown	Unknown	Merrimack River Basin	Fourth flood recorded in the lower Merrimack River basin at Manchester, New Hampshire.
06/15-16/1943	25 to >50	Unknown	Upper Connecticut, Diamond and Androscoggin	Intense rainfall exceeding 4 inches; highest stream stages of record in parts of the affected area.
June 1944	Unknown	Unknown	Merrimack River Basin	One of the five highest known floods at Manchester on the Merrimack.
November 1950	Unknown	Unknown	Contoocook River and Nubanusit Brook	Localized storm resulted in flooding of this area.
03/27/1953	25 to >50	Little Damage	Lower Androscoggin, Saco, Ossipee, upper Ammonoosuc, Israel, and Ammonosuc Rivers.	Peak of record for Saco and Ossipee Rivers.
10/25/1959	25 to >50	Unknown	White Mountain area; Saco. upper Pemigewasset, and Ammonoosuc Rivers.	Largest of record on Ammonoosuc at Bethlehem Junction; third largest of record on Pemigewasset and Saco Rivers.
December 1959	Unknown	Damage was heavy along the coast.	Piscataquog - Portsmouth	A Nor'easter brought tides exceeding maximum tidal flood levels in Portsmouth.
April 1960	Unknown	Unknown	Merrimack and Piscataquog	Flooding resulted from rapid melting of deep snow cover and the moderate to heavy rainfall. Third highest flood of record on the rivers.
April 1969	Unknown	Unknown	Merrimack River Basin	Record depth of snow cover in the Merrimack River Basin and elsewhere resulted in excessive snowmelt and runoff when combined with sporadic rainfall.
February 1972	Unknown	Damage was heavy along the coast.	Coastal Area	Coastal area was declared a National Disaster Area as a result of the devastating effects of a severe coastal storm.
June 1972	Unknown	Unknown	Pemigewasset River	Five days of heavy rain caused some of the worst flooding since 1927 along streams in the upper part of the State, damage was extensive along the Pemigewasset River and smaller streams in northern areas.

Event Date	Recurrence Interval	Impacts	Location	Additional Information
06/30/1973	25 to >50	Unknown	Ammonoosuc River	Northwestern White Mountains
April 1976	Unknown	Unknown	Connecticut River	Rain and snowmelt brought the river to 1972 levels, flooding roads and croplands.
03/14/1977	25 to 50	Unknown	South-central and Coastal New Hampshire	Peak of record for Soucook River
February, 1978 ("The Blizzard of '78)	Unknown	Significant	Statewide	Nor'easter brought strong winds and precipitation to the entire state. Hardest hit area was the coastline, with wave action and floodwaters destroying homes. Roads all along the coast were breached by waves flooding over to meet the rising tidal waters in the marshes.
July 1986 – 08/10/1986	Unknown	Met Disaster Thresholds	Statewide	DR-771: Severe summer storms with heavy rains, tornadoes; flash flood and severe winds
03/31-04/02/1987	25 to 50	Precursor to a significant, following event	Androscoggin, Saco, Ossipee, Piscataquog, Pemigewasset, Merrimack & Contoocook River	Caused by snowmelt and intense rain.
04/06-7/1987	25 to >50	Met Disaster Thresholds	Lamprey River and Beaver Brook	DR-789: Large rainfall event following the March 31- April 2 storm.
08/07-11/1990	Unknown	Met Disaster Thresholds	Statewide	DR-876: Series of storm events from August 7-11, 1990 with moderate to heavy rains during this period produced widespread flooding.
08/19/1991	Unknown	Extensive damage in Rockingham and Strafford counties, but the effects were felt statewide.	Statewide	DR-917: Hurricane Bob struck New Hampshire
October 1995	Unknown	Met Disaster Thresholds	Northern and Western Regions	DR-1077: Counties declared: Carroll, Cheshire, Coos, Grafton, Merrimack, and Sullivan.
11/20-23/1996	Unknown	Met Disaster Thresholds	Northern and Western Regions	DR-1144: Counties declared: Grafton, Hillsborough, Merrimack, Rockingham, Strafford, and Sullivan.
06/12-07/02/1998	Unknown	Met Disaster Thresholds	Central and Southern Regions	DR-1231: Series of rainfall events. Counties declared: Belknap, Grafton, Carroll, Merrimack, Rockingham and Sullivan. (1fatality) (Several weeks earlier, significant flooding, due to rain and rapid snowpack melting, occurred in Coos County, undeclared in this event. Heavy damage to secondary roads occurred.

Event Date	Recurrence Interval	Impacts	Location	Additional Information
09/18/19/1999	Unknown	$594,693.82 Pubic Assistance	Central and Southern Regions	DR-1305: Heavy rains associated with Tropical Storm/Hurricane Floyd. Counties declared: Belknap, Cheshire and Grafton.
07/21-8/18/2003	50	$973,986.52 Public Assistance	Southwestern Region	DR-1489: Severe storms and flooding occurred in Cheshire and Sullivan counties.
10/7-18/2005	Exceeded 100 in some areas	$12,314,320.29 Public Assistance $1,102,655.35 Individual Assistance 40 Homes demolished, 4 miles of Route 123 destroyed, and 4 fatalities in Alstead[57]	Southwestern Region	DR-1610: Heavy rains associated with Tropical Storm Tammy and Subtropical Depression 22 resulted in 6-15 inches of rain.
05/12/2006 "Mother's Day Floods"	100 – 500yr	$14,406,821.44 Public Assistance $8,999,191.49 Individual Assistance	Central and Southern Regions	DR-1643: Heavy rainfall 8-16 inches
04/15-23/2007	100 – 500yr	$23,206,682.33 Public Assistance $3,509,042.32 Individual Assistance	Statewide	DR-1695: Severe storms and flooding associated with a Nor'easter
07/24/2008	50 – 100yr	$1,269,313.62 Public Assistance	Belknap, Carroll, Merrimack, Rockingham, and Strafford Counties	DR-1782: Severe storms, tornado, and flooding,
07/24-08/14/2008	50 – 100yr	$3,673,172.45 Public Assistance	Belknap, Carroll, Coos, Grafton Counties	DR-1787: Severe storms and flooding
09/06-07/2008	50 – 100yr	$823,848.76 Public Assistance	Merrimack and Hillsborough Counties	DR-1799: Severe storms and flooding
03/14-31/2010	50 – 100yr	$2,489,369.98 Public Assistance	Hillsborough and Rockingham Counties	DR-1913: Severe storms and flooding
05/26-30/2011	50yr	$1,218,835.96 Public Assistance	Coos and Grafton Counties	DR-4006: Severe Storms and Flooding
08/26-09/06/2011	100yr	$18,091,902.88 Public Assistance $1,262,644.95 Individual Assistance	Belknap, Carroll, Coos, Grafton, Merrimack, Strafford, and Sullivan Counties	DR-4026: Tropical Storm Irene
06/18/2012	Unknown	$3,039,192.36 Public Assistance	Cheshire County	DR-4065: Severe Storm and Flooding
10/26-11/08/2012	Unknown	$2,113,605.92 Public Assistance Numerous roads across the state flooded and were damaged, bridges, and banks eroded and scoured	Belknap Carroll, Coos, Grafton, Rockingham, and Sullivan Counties	DR-4095: Hurricane Sandy

[57] http://www.wmur.com/article/10-years-later-alstead-flood-victims-look-back-1/5204620

Event Date	Recurrence Interval	Impacts	Location	Additional Information
06/26-07/03/2013	Unknown	$5,885,717.69 Public Assistance A culvert passing a brook under Slayton Hill Road at the top of the hill south of Route 4 was unable to pass flows created by heavy rain from a thunderstorm. Culvert overtopped, forcing flows to flow down Slayton Hill Road. Force of flow excavated the road and its adjacent terrain away, with all the excavated material depositing at the bottom of the hill at the intersection with Dulac Street. Merriam Brook channel completely filled in with boulders and cobbles, deposited from the heavy-rain induced flash flood event, eliminating the ability of the channel to convey water, and forcing the brook onto the back lawn of a residence Joslin Road. Merriam Brook began the process of forming a new channel for itself on the back lawn of a residence Joslin Road in Surry.	Cheshire, Grafton, and Sullivan Counties	DR-4139: Severe Storms, Flooding, and Landslides White Bridge Brook channel upstream of Route 12 was completely reconfigured, with extensive sediment deposition, forcing water and river sediment onto the lawn of a business, and then paralleling Route 12 before re-entering Mill Brook downstream.
03/31/2014	Unknown	In Winchester - 12 roads washed out or heavily damaged including 120' section of Old Westport Road – estimated more than $1m in damages. Area communities received 2.4-5.6" of rain. 96 homes affected, 26 homes stranded.[58] Portsmouth experienced localized flooding.	Monadnock and Seacoast Areas	

[58] http://www.sentinelsource.com/news/local/winchester-residents-cleaning-up-after-flooding/article_a6a6c0e4-e407-5f2e-8343-a80b593bd2fd.html

Event Date	Recurrence Interval	Impacts	Location	Additional Information
04/15-17/2014	Unknown	Mohawk River erosion caused a portion of the rock foundation under Howard's Restaurant to fail. High water closed state roads leading to and from Colebrook, isolating portions of town. Closure of Route 26 at Roaring Brook Road. Schoolhouse Brook flooded in the Spring of 2015 washing out part of Meriden Hill Road. Black Mountain Road flooded, and in Shelburne Brookfield Power had to pull boards on the Shelburne Hydro Dam to prevent it from going over Route 2 which caused flooding in town.	Colebrook, Columbia, Lincoln, Shelburne, Stratford	Rapid snowmelt and heavy rain combined with the effects of clear cutting (some locations) led to flooding of Old Mill Rd, Route 3, and Stratford Hollow in Stratford.
06/26/2014	Unknown	Route 112 closed from high water. Lost River overflowed and some of the Lost River Valley Campground was evacuated, with no injuries reported. On Moosilauke Brook, the channel had capacity reduced from sediment deposition over time, reducing flow capacity, with water and river cobbles/gravel traveling and depositing onto the property of one home in North Woodstock, which led to basement flooding.	Woodstock	

Event Date	Recurrence Interval	Impacts	Location	Additional Information
07/15-16/2014	Unknown	Road washouts, basements flooded, with residents at 26 homes stranded on Fosgate, Jantti, Old Swanzey, Purcell and Watson Roads . Runoff damage to Route 119 at the intersection of Gunn Mountain Road. Twelve (12) roads washed out or heavily damaged, with one 120-foot section of Old Westport Road washed out from culvert failure and attendant induced bank erosion on Ashuelot River, which parallels the road.	Winchester	
October 2014	Unknown	Berea Road flooded and washed out	Hebron	
2015	Unknown	Next to the Merrimack River, the state access road (New Hampshire Fish & Game) is being washed out. Road only leads to conservation land, but is being washed out by the river, and town could not respond to fire or ambulance calls in the area. Railroad tracks 20 feet from road and are in danger of being eroded.	Merrimack River in Canterbury	
08/15/2015	Unknown	Damaging winds, hail, torrential rainfall, lightning. Fallen tree into a home in Bristol.	Lakes Region, Central, and Southwestern New Hampshire	Keene experienced training thunderstorms which dropped more than 3" of rain.

Event Date	Recurrence Interval	Impacts	Location	Additional Information
10/21/2016	Unknown	Significant flooding in Manchester and Nashua closing streets. In Nashua, sewer main covers were popping off. Flooding at Brentwood PD Mast Rd. in Goffstown Closed[59] A teenager was killed when he was swept into a storm drain in Nashua.[60]	Southern New Hampshire	Numerous Fire and Rescue calls in Manchester and Nashua rescuing people from cars on flooded city streets. Nashua fire received more than 50 calls for service in the three-hour period of rain. According to the National Weather Service, the storm dumped 3.49 inches of rain on Manchester, the most in the state. Nashua got 2.79 inches. The town of Newton received 3.46 inches, while 3.39 inches of rain poured down on Stratham. Exeter received 3.29 inches and Londonderry received 3.14 inches.[61]
02/27/2017	Unknown	50 vehicles at Plymouth State University were flooded when an ice jam pushed water into the parking lot and then the water froze around the cars due to the low temperatures[62]	Plymouth	
07/01-02/2017	Unknown	Detours due to flooding, flood and wind damage. Route 117 in Sugar Hill Closed. Jellystone Campground in New Hampton had to evacuate nearly 200 people and four vehicles were flooded. Culvert blown out in Orford 4 people and a dog rescued in Campton[63]	Grafton county	DR-4329: Severe Storms and Flooding, 7 tornado warnings issued in New Hampshire and Western Maine on July 1st – usually NWS Gray issues no more than 6 in an entire year.

[59] http://www.unionleader.com/weather/torrential-rain-causes-flash-flooding-across-southern-new-hampshire-20161022

[60] https://www.bostonglobe.com/metro/2016/10/24/nashua-officials-unsure-why-manhole-was-uncovered-before-fatal-fall-that-killed-teenager/erKhiLccH0Tj3W2HxQOovM/story.html

[61] http://www.unionleader.com/Storm-kept-Manchester,-Nashua-firefighters-busy-with-rescues-Friday-night

[62] http://www.wmur.com/article/exit-25-on-i-93-route-175a-closed-for-flooding-due-to-ice-jam/8982054

[63] http://www.wmur.com/article/granite-state-cleans-up-after-wild-weather-causes-flooding-wind-damage/10251436

Other Events:

Event Date	Event	Impacts	Location	Additional Information
01/31/2013	Ice Jam	Ice jam caused water to flow over Beauregard Street. No homes damaged.	Claremont	
12/29/2013	Overwhelmed Stream Crossing	Rainwater overwhelmed the stream crossing, flooded the road, and 1.5 feet of gravel was required to repair	Henniker	Mount Hunger Road
03/21/2014	Ice Jam	Ice jam caused water to flow into parking lots adjacent to the Sugar River.	Claremont	
February 2015	Ice Jam	Ice jam on Saco River. No impacts.	Conway	Saco River near Melody Lane at Center Conway
April 2015	Beaver Dam	Beaver dam issues caused Forest Road to become underwater.	Greenfield	Forest Road at Lyndeborough town line
February 2016	Ice Jam	Ice jam on Gale River. Caused inundation of Plantation Road, including to one field and home (water up to the windows, 4 foot depth).	Franconia	
02/26/2017	Ice Jam	Ice jam on the Pemigewasset River at Holderness caused flooding in Holderness and the Plymouth State University parking lot where parked cars became submerged	Holderness-Plymouth	

Drought

HIRA Risk: Low
Future Probability: Medium
Counties at Risk: All

Definition:

Drought is a complex phenomenon that is difficult to monitor and define. A drought is essentially the absence of water in a region that occurs slowly due to below-average precipitation over an extended period, resulting in low stream flows, low surface water, and low groundwater levels.[64] According to NOAA, the climatological community has defined four types of droughts to address their cause(s), timeframe, and effects[65]:

- Meteorological Drought: Occurs when dry weather patterns dominate an area, resulting in a lack of precipitation
- Hydrological Drought: Occurs when low water supply becomes evident, especially in streams, reservoirs, and groundwater levels—usually after many months of meteorological drought
- Agricultural Drought: Occurs when crops become affected by drought conditions
- Socioeconomic Drought: Effects of supply and demand of commodities affected by drought conditions

Drought is defined as an abnormal lack of moisture relative to long term climatic averages (30 years or longer) for any given region. Conditions that define a drought for one climate zone cannot be applied universally to others. Likewise, drought conditions should not be confused with aridity, which describes a permanent feature of climate, rather than a temporary deviation from normal climate behavior.[66]

Location:

The entire State of New Hampshire is at risk for a drought. The State has been divided up into five drought management areas in order to effectively monitor for and respond to drought conditions:[67]

Background and evolving hazard information:

It is commonly misunderstood that droughts are a rare and random event; drought is a normal, recurrent feature of climate. Although New Hampshire is often thought of as a water-rich State, it may be even more susceptible to drought than other states due to its geology according to the DES.[68] The State of New Hampshire has experienced drought conditions numerous times, most recently in 2016.

Drought conditions may exist simultaneously over several states or be confined to a small area or areas within a single state. Likewise, the severity or effects of drought may have considerable spatial variability

[64] https://www.des.nh.gov/organization/divisions/water/dam/drought/index.htm
[65] https://www.ncdc.noaa.gov/monitoring-references/dyk/drought-definition
[66] https://www.des.nh.gov/organization/divisions/water/dam/drought/documents/unhdroughtanalysis.pdf.pdf
[67] https://www.des.nh.gov/organization/divisions/water/dam/drought/documents/drought-management-plan-for-web.pdf
[68] https://www.des.nh.gov/organization/divisions/water/dam/drought/index.htm

due to a variety of factors, such as unequal distribution of rainfall, differences in topography and soil, varying drainage patterns, and differing geologic formations. In addition to lack of precipitation, other atmospheric conditions such as increased temperatures, wind and solar radiation can also contribute to excessive drying. In New Hampshire, meteorological dry periods (reduced precipitation) and hydrologic dry periods (below normal stream flow) are typically concurrent. The development of hydrologic dry periods is largely dependent on the development and persistence of meteorological dry periods.[69] With this in mind, the State has been divided up into the five drought management areas to take into consideration the environmental variances in different parts of the State.

During a meteorological drought, water stored in aquifers and surface reservoirs becomes increasingly important to offset the precipitation deficit, especially in areas of high agricultural production. New Hampshire's aquifers are constrained in both areal extent and potential yield by the State's underlying geology (USGS, 1996). Unconsolidated sand and gravel make up only 14% of our subsurface deposits, and are typically less than 100 feet thick (NHDES, 2008). In addition to our restricted groundwater storage, the State's surface water impoundments are generally targeted towards recreation and flood control, but also provide a mechanism for managing water supply, though with limited surface storage (NHDES, 2008). Thus, with New Hampshire's limited long-term water storage, even short-term precipitation deficits can have serious consequences for the State's water use. Private well owners are greatly impacted by drought conditions. When wells fail, the homeowner must spend roughly $5,000-$30,000 dollars to modify existing wells or drill new wells. During the drought of 2016, hundreds of wells across New Hampshire failed and many homeowners did not have the financial resources to address the problem. Business and public water systems are also impacted by drought; however, many of these entities in New Hampshire made improvements to these systems, such as increased storage, diversification of water sources, and water use efficiency, following the drought of 2001-2003.

Hydrological drought is caused by extended periods of negative departures from rainfall averages. Four droughts of significant extent and duration were evident in New Hampshire during the 20th century. The drought of 1929-1936 coincided with severe drought conditions in large areas of the central and eastern United States. The most severe drought recorded in New Hampshire occurred from 1960 to 1969. This drought encompassed most of the northeastern United States. Historically, droughts in New Hampshire have had limited effect because of the plentiful water resources and sparse population. Since 1960 the population has more than doubled, which has increased demand for the State's water resources. Further droughts may have considerable effect on the State's densely populated areas along the seacoast and in the south-central area.[70]

Agriculture and its associated socioeconomics often suffer as a result of drought conditions. Agriculture in New Hampshire is most vulnerable to the impacts of drought, especially dairy farmers. Dairy farmers, who typically grow their own food for the cows, are not able to produce enough feed for their livestock during drought conditions. This requires dairy farmers to purchase food, raising the cost of production in a market where milk availability is high and prices are already at record lows.[71] Crop farmers are also impacted by drought conditions. They have the ability to purchase drought insurance, but many entities

[69] https://www.des.nh.gov/organization/divisions/water/dam/drought/documents/unhdroughtanalysis.pdf.pdf
[70] NH DES Drought Historical Events
[71] http://nhpr.org/post/extreme-drought-low-milk-prices-have-nhs-dairy-farms-facing-crisis#stream/0

in New Hampshire do not. Additionally, drought conditions can lower water levels on ponds, lakes, and rivers leading to decreased opportunity for water recreation activities in summer and fall.

The ski industry in New Hampshire, which brought in a combined total of direct and secondary spending of approximately $1.1 billion during the 2012-13 winter season, according to a study by Plymouth State University[72], has been severely impacted by persistent drought conditions. Although most ski areas have snowmaking capabilities to make up for a temporary snowfall deficit, extended wintertime droughts may greatly impact their ability to make snow as their water supply ponds become dewatered. Additionally, studies[73,74] have shown that the ski season in New England is shrinking as the climate warms, adding further stress to a vital State economic resource.

A product that is used nationwide to monitor drought is the US Drought Monitor. The US Drought Monitor, established in 1999, is a weekly map of drought conditions that is produced jointly by NOAA, the US Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The US Drought Monitor website is hosted and maintained by the NDMC. US Drought Monitor maps come out every Thursday morning at 8:30 Eastern Time, based on data through 7 a.m. Eastern Standard Time (8 a.m. Eastern Daylight Time) the preceding Tuesday. The map is based on measurements of climatic, hydrologic, and soil conditions as well as reported impacts and observations from more than 350 contributors around the Country. Eleven climatologists from the partner organizations take turns serving as the lead author each week. The authors examine all the data and use their best judgment to reconcile any differences in what different sources are saying.

The US Drought Monitor, a composite index that includes many indicators, is the drought map that policymakers and media use in discussions of drought and in allocating drought relief. The US Department of Agriculture's Farm Service Agency used the US Drought Monitor to distribute an estimated $1.64 billion from 2008 to 2011 through the Livestock Forage Disaster Program, $50 million in 2007 through the Livestock Assistance Grant Program, and additional funds through the Non-Fat Dry Milk Program in 2003 and 2004. The Internal Revenue Service (IRS) also uses the US Drought Monitor to determine the replacement period for livestock sold because of drought. As part of its response to the drought of 2012, the US Department of Agriculture streamlined the process for secretarial disaster declarations, making declarations nearly automatic for a county shown in severe drought on the US Drought Monitor for eight consecutive weeks.[75]

[72] https://www.skinh.com/uploads/images/layout/header_images/Economic%20Impact%20study%20INHS%202012-13%20final.pdf

[73] https://scholars.unh.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1180&context=soc_facpub

[74] https://www.cabdirect.org/cabdirect/abstract/20143357113

[75] http://droughtmonitor.unl.edu/AboutUSDM/Background.aspx

	WATCH D0 Abnormally Dry	ALERT D1 Moderate	WARNING D2 Severe	EMERGENCY D3 Extreme	DISASTER D4 Exceptional
Conditions to be used by NH Drought Management Team as basis for recommendations to the US Drought Monitor					
PRECIPITATION 1-month SPI 3-month SPI 6-month SPI 12-month SPI	<0.0 Not Applicable Not Applicable Not Applicable	Not Applicable <0.0 Not Applicable Not Applicable	Not Applicable <-1.0 Not Applicable Not Applicable	Not Applicable Not Applicable <-1.0 Not Applicable	Not Applicable Not Applicable Not Applicable <-1.0
STREAMFLOW 28-day streamflow 65% normal	Up to 1 Month	1-3 Months	3-6 Months	6-9 Months	>9Months
PALMER INDEX PDSI	Not Applicable	<0.0	<-1.0	<-2.0	<-3.0
GROUNDWATER	Not Applicable	Monthly Levels Drop Below Mean	Monthly Levels Persist Below Monthly Mean		Not Quantified

Drought parameters found in the NHDES Drought Management Plan. *(Source-NHDES)*

NHDES has developed parameters to be used by the New Hampshire Drought Management Team as a basis for recommendations to the US Drought Monitor and has also developed general responses to the stages of drought in drought management areas. More information regarding the State response to drought can be found in the NHDES Drought Management Plan[76].

[76] DES Drought Management Plan

Extent:

The severity of a drought is assessed using the US Drought Monitor's intensity scale[77]:

Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 or less	0-2	0-2	-2.0 or less	0-2

[77] http://droughtmonitor.unl.edu/AboutUs/ClassificationScheme.aspx

Impacts[78]:

- Economic Impacts
  - Destruction of crops affecting farmers and consumers driving up food costs for consumers
  - Cost of irrigation and drilling new wells
  - Farmers spending more money on water and feed for animals
  - Businesses that rely on farming, such as tractor and feed suppliers, may lose income
  - Timber industry workers may be affected if wildfires exacerbated by drought destroy timber
  - Businesses that sell boating and fishing equipment may lose business due to dried up water sources
  - Power companies that utilize hydroelectric may have to spend money on other fuel sources and customers may also have to pay more for power
  - Barges and ships may have difficult navigating bodies of water due to the ships draft (water depth required for boat to be able to operate) being greater than the depth of the body of water
  - Water companies having to spend money on new or additional water supplies
- Environmental Impacts
  - Loss or destruction of fish and wildlife habitat
  - Lack of food and drinking water for wild animals
  - Increased stress on and possible extinction of endangered species
  - Lower water levels in reservoirs, lakes, and ponds
  - Loss of wetlands
  - More frequent wildfires—the number of wildfires in 2016 increased over 250% from 2015 with a total of 351 fired reported and 1,090 acres burned[79]
  - Wind and water erosion of soils
  - Poor soil quality
- Social Impacts
  - Anxiety or depression about economic losses caused by drought
  - Health problems related to poor water quality
  - Health problems related to dust and pollen
  - Loss of life
  - Threat to public safety from an increased number of wildfires
  - Reduced incomes
  - People may have to relocate or close farms
  - Fewer recreational activities

The number of woodland fires in New Hampshire increased by over 200% during the 2016-2017 drought.[80] The persistent dry conditions resulted smaller, more local water resources to dry up. This forced first responders to travel further to find firefighting water sources. Additionally, the excessively dry conditions caused the forest bed to be drier at deeper levels, making them difficult to extinguish. These fires often "go underground" and resurface days after they were thought to be extinguished,

[78] National Drought Mitigation Center
[79] https://www.jackson-nh.org/sites/jacksonnh/files/uploads/2016_forest_fire_warden_town_report.pdf
[80] https://www.jackson-nh.org/sites/jacksonnh/files/uploads/2016_forest_fire_warden_town_report.pdf

putting further strain on firefighting resources. The following are factors that lead to a potential for increased woodland fires during a drought:

- The average length of snowpack has decreased by 12 days over the last 50 years, causing bare ground to be exposed longer and forests to be more susceptible fires during a drought[81].
- Warmer temperatures are allowing disease and insects to move north, killing trees which provide more fuel for fires.
- Other extreme weather events, such as wind storms or ice storms, are downing more trees adding fuel for fires during a drought.

Overall, the Northeast, including New Hampshire, will likely continue to see an overall increase in extreme events, including drought. The transient climate has shown that temperatures and the length of the growing season are increasing in New Hampshire. This indicates that future droughts will likely be more severe in the future.

Previous Occurrences[82838485]:

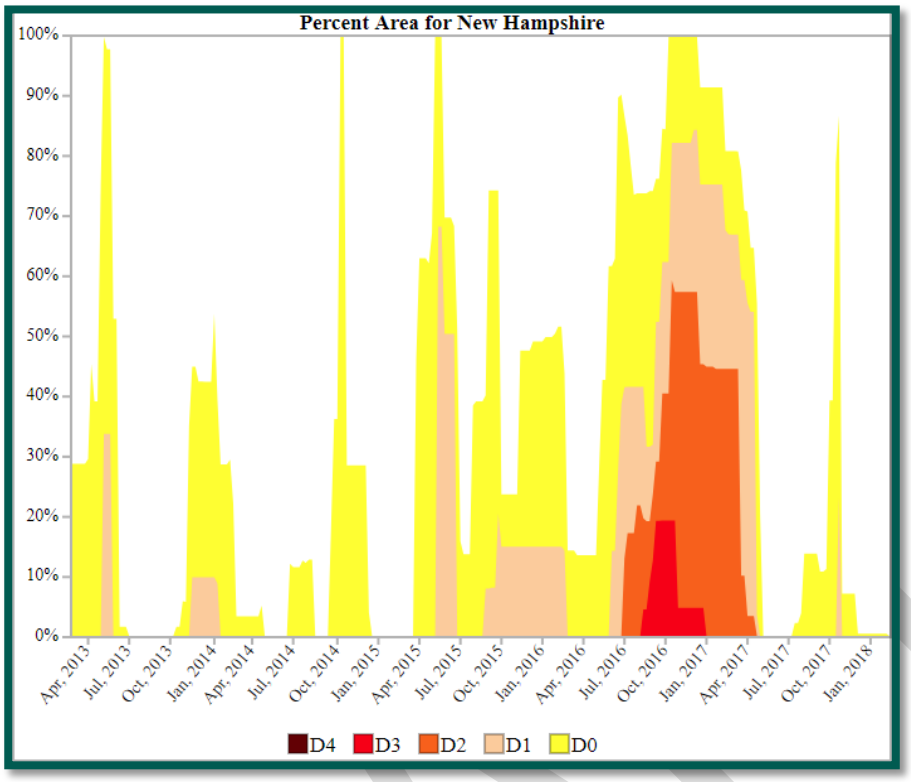
The table below highlights the best known data for significant historical occurrences of drought and their associated impacts for the State of New Hampshire.

Event Date	Event Description	Impacts	Location	Additional Information
1775	Drought	No specific impacts available	Statewide	In Hopkinton – "all the cattle of the township were collected upon the banks of the Contoocook River and kept till the dryness abated".[86]
1840	Drought	No specific impacts available	Statewide	In Hopkinton – "Conditions were so dry that there was not a green blade of grass [on Gould's hills] …" "…trees were lopped in the pastures to supply leaves for food for the stock".[24]
1882	Drought	No specific impacts available	Statewide	No specific details available[24]
1910s	Drought	No specific impacts available	Statewide	Significant Drought Conditions
1929-1936	Regional Drought	No specific impacts available	Statewide	10 to >25yr recurrence interval
1939-1944	Regional Drought	No specific impacts available	Statewide	10 to >25yr recurrence interval, severe in southeast and moderate elsewhere.
1947-1950	Moderate Drought	No specific impacts available	Statewide	10-25yr recurrence interval

[81] https://www.outdoors.org/articles/amc-outdoors/are-white-mountain-wildfires-in-the-forecast
[82] NH DES Drought Historical Events
[83] https://md.water.usgs.gov/publications/wsp-2375/nh/
[84] http://www.newenglandhistoricalsociety.com/1965-drought-new-englands-worst-ever/
[85] https://www.drought.gov/drought/states/new-hampshire
[86] Life and Times in Hopkinton p.280

Event Date	Event Description	Impacts	Location	Additional Information
1960-1969	Severe Regional Drought	High Pollen Count, High Fire Danger, and high prices for produce, wells dried up, rivers, ponds and reservoirs became mud holes. Foggy mornings disappeared. Water Emergencies and Restrictions. Wild birds had trouble getting fish.	Statewide	>25yr recurrence interval. Regional longest recorded continuous spell of less than normal precipitation. President Johnson ordered a study to find out what could be done to help New England.
1999	Drought	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred.	Statewide	Water systems in Salem and Hampton/North Hampton were in danger of running out of water.
2001-2002	Severe Drought	Numerous forest fires. Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred.	Statewide	Water systems in Salem and Seabrook were in danger of running out of water. Hundreds of private wells failed.
2016-2017	Extreme Drought	Water systems and private wells were adversely impacted by the drought. Impacts to agricultural crops also occurred. Hundreds of private wells failed.	Statewide	Areas of the state between D1-D3. 19 of the State's 120 dairy farms closed. The State had lost 10 farms over the previous four years combined. This was the first time that an Extreme drought had been declared for New Hampshire since the National Drought Monitor became operational in 2000. Conditions in 2016 were similar to that of droughts observed in 1995, 1978, and 1964. *See graphic below showing severity of this drought in comparison to conditions between 2013 and 2018.*[87]

[87] https://www.drought.gov/drought/states/new-hampshire



Screenshot from the New Hampshire section of drought.gov depicting the drought conditions in the State between April 2013 and January 2018. The 2016-2017 drought is clearly evident in the recent historical data. The period of extreme drought is denoted in dark red. *(Source: NHDES)*

Earthquake (>/=4.0)
HIRA Risk: Low
Future Probability: Medium
Counties at Risk: All

Definition:
The United States Geological Survey (USGS) defines an earthquake as a sudden slip on a fault. Tectonic plates are always slowly moving, but can get stuck on edges due to friction. When the stress on the plates overcomes the friction, there is an earthquake that releases an energy wave that travels through the earth's crust.[88] The earthquake hazard is anything associated with an earthquake that may affect the normal activities of people; such as, surface faulting, ground shaking, landslides, tsunamis, structural damage, etc.[89] The underground point of origin of an earthquake is called its focus; the point on the surface directly above the focus is the epicenter. There are two primary ways in which earthquakes are measured, magnitude (the size of the earthquake) and intensity (measure of the shaking and damage, which can vary from location to location). Magnitude is measured in the Moment Magnitude scale (based off the obsolete Richter scale). The Modified Mercalli Intensity (MMI) classifies the perceived feeling of the earthquake.

For the purposes of this plan, the SHMPC determined that since minor earthquakes are a common occurrence in New Hampshire, the focus of this section should be on those earthquakes which have the potential to harm life, property, and the environment. After reviewing the Modified Mercalli Intensity (MMI) Scale and the Moment Magnitude scale, the committee determined that earthquakes that are greater than or equal to a 4 on either scale have the greatest potential to affect life, property, and the environment.

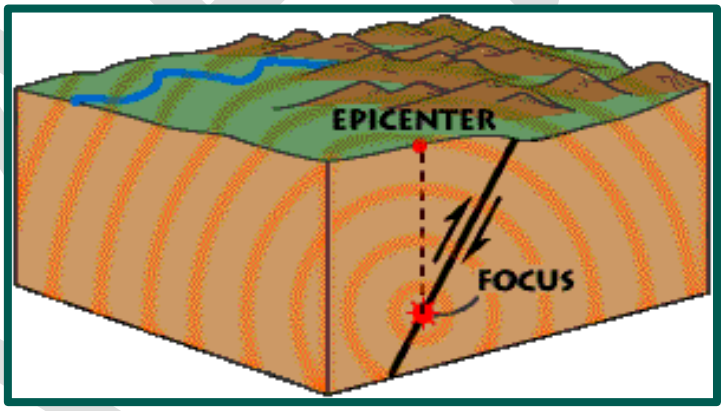
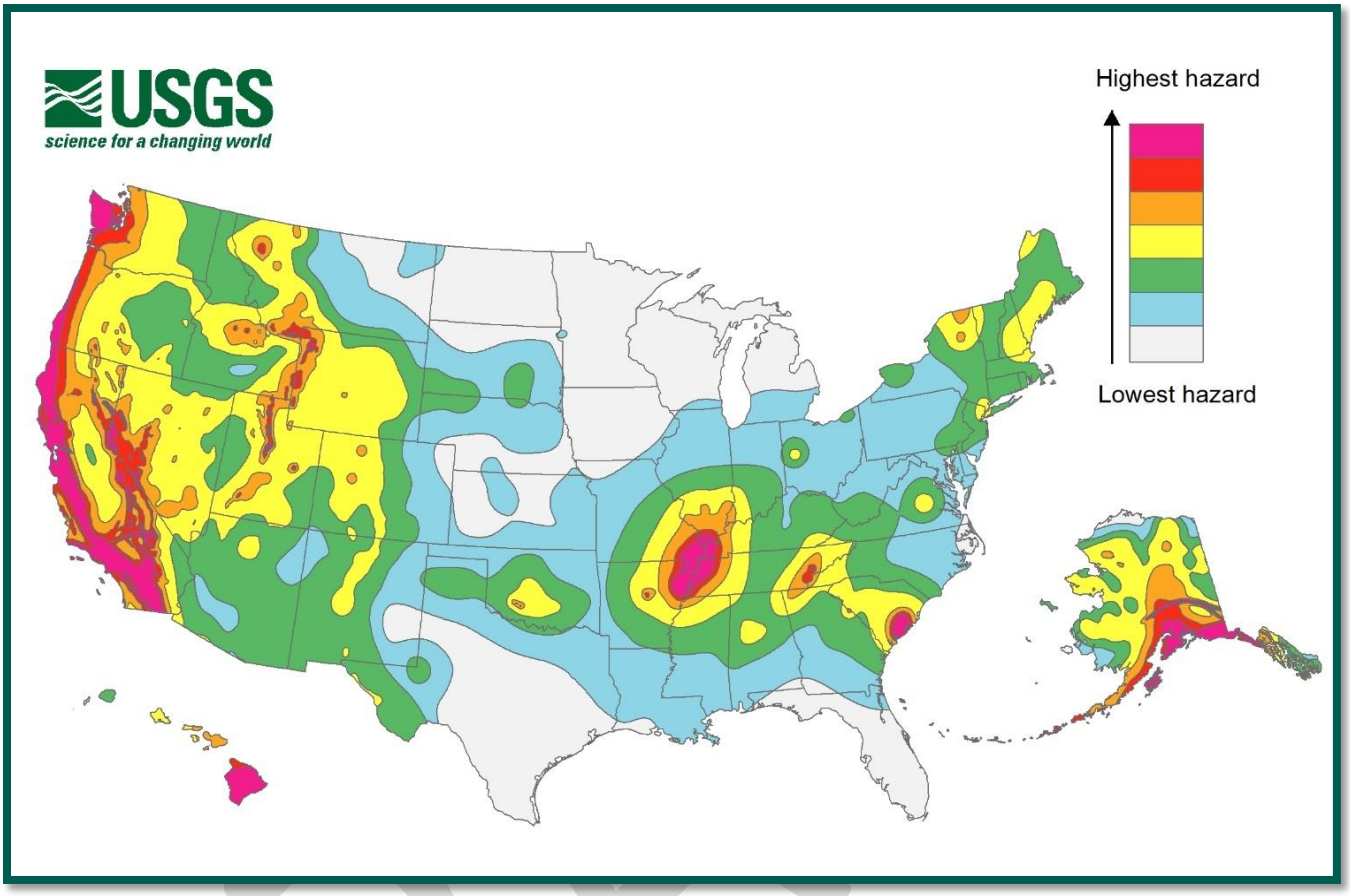


Diagram of a fault line depicting the locations of the focus and epicenters of the fault. *(Source: USGS)*

Location:
The entire State of New Hampshire is at risk for Earthquakes. There is no typical season for earthquakes, they can occur at any time.

[88] https://www2.usgs.gov/faq/categories/9827/3343
[89] https://earthquake.usgs.gov/learn/glossary/?term=earthquake%20hazard



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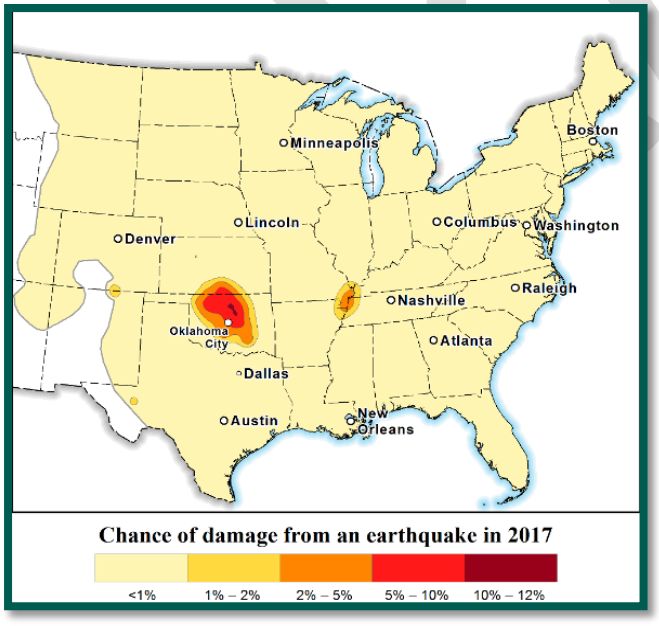


(TOP) – The USGS develops a long-term model of earthquake hazards across the United States every four years, with the most recent being from 2014. This represents an assessment of the best available science in earthquake hazards and incorporates new findings on earthquake ground shaking, faults seismicity, and geodesy. This map is used in seismic provisions of building codes, insurance rate structures, risk assessments, and other public policy. The model was last updated in 2014.

(LEFT) – Each year the USGS develops a one-year seismic hazard forecast for the central and eastern United States from Induced and Natural Earthquakes. Previous years data is fed into the models to continue to improve the forecasting model. This map represents the possibility of receiving a damaging earthquake in 2017.

91

[90] https://earthquake.usgs.gov/hazards/hazmaps/conterminous/index.php

Background and evolving hazard information:

New Hampshire is considered to be an area of moderate seismic hazard. This means that the State could experience large (6.5-7.0 magnitude) earthquakes, but they are not likely to occur as frequently as in a high hazard area like California. The State typically experiences one or two earthquakes per year registering magnitude 2.0 to 3.5 and numerous other smaller ones.


DAMAGE HERE SLIGHT IN 'QUAKE
Hollis Tot Killed By Milk Truck
NASHUA TELEGRAPH
WARSHIPS POUR DEATH ON VALONA
Albanian Port In

(Source: Nashua Telegraph)

According to the NH HSEM and the US Geological Survey, the overall earthquake risk to the State is high.[92] Many structures in the State (e.g., buildings, homes, bridges, and highways) are old or not built to modern earthquake standards. Hence, they are unable to withstand earthquakes. New Hampshire has had, and will continue to experience, large damaging earthquakes; however, the intervals between such events are greater in New Hampshire than in high seismic hazard areas. For the purposes of this plan, the overall risk to New Hampshire from low from the perspective of identifying earthquakes that are of magnitude 4.0 or greater

Many faults are mapped in New Hampshire as well as the rest of New England. New Hampshire is in the low attenuation of seismic waves in the eastern United States. No earthquake focus in New Hampshire can be directly correlated to any structural feature such as a fault, nor do the mapped earthquake epicenters sense linear features such as faults and shatter zones. Observations along mapped faults in the State indicate that they are healed, and probably have not been active for perhaps 90 million years or more. In short, the earthquakes record in New Hampshire is clear and short-based; but the cause is still unknown.[93]

There is a general rule that the longer an earthquake waits to happen (as the strain builds up), the more powerful the earthquake will be. There is also a corresponding observation that the deeper in the crust the focus of the earthquake is, the more powerful it will be. With that information in mind, it is clear that New Hampshire is vulnerable to destructive earthquakes; however, it is impossible to calculate the probability accurately because the seismic record (less than three centuries) is of relatively short duration.

The earthquakes felt in New Hampshire do not necessarily relate to epicenters within the State. Epicenters in other surrounding states, Canada, and on the Atlantic sea floor have contributed to the record. The crystalline rocks of northeastern United States and Canada are relatively cooler in crustal context, and propagate seismic energy as much as ten times further than, for comparison, the crustally warmer rocks of the California coast. It is important to point out that the strongest quakes to hit the State had external epicenters.

[91] https://www.sciencebase.gov/catalog/item/58796c61e4b04df303d97f0d
[92] https://www.nh.gov/safety/divisions/hsem/NaturalHazards/index.html
[93] https://www.des.nh.gov/organization/commissioner/pip/factsheets/geo/documents/geo-3.pdf

The record is complete enough to allow seismologists to compute occurrence probabilities for earthquakes in New England ranging from magnitude 4.6 to 6.0. Thus, earthquakes will continue to occur in New Hampshire with at least the same frequency and magnitude as in the past.

After a damaging earthquake, it can be expected that there will be widespread damage due to aging infrastructure. There are many un-reinforced masonry structures still in use and much of our infrastructure, including bridges and many of our gas and waterlines, are very vulnerable to seismic forces. Older and historic structures should be a primary concern, but many of our newer structures are not built to any seismic building codes and therefore are also vulnerable. Damages from an earthquake generally fall into two categories: Structural and Nonstructural.

- Structural Damage is any damage to the load-bearing components of a building or other structure.
- Nonstructural Damage is any portion not connected to the superstructure. This includes anything added after the frame is complete; such as lighting fixtures, bookcases, utilities, etc.

The term "built environment" is used by seismologists to characterize the works of man. Earthquake protection has been designed into only a few New Hampshire buildings, public works, or utilities, leaving the majority of structures particularly vulnerable. The built environment on artificial fill and stratified glacial deposits (sand, gravel, silt, and clay) is particularly vulnerable because of the magnified attenuation of earthquake energy by these deposits producing locally increased ground motion. By contrast, buildings built on bedrock and glacial till are less vulnerable.[94]

Attenuation is a term in physics that means the slow loss of intensity of flow through any kind of medium. Seismic waves can cover an area 4 to 40 times greater here than they do in the west because of the cold hard rock geology of New Hampshire. The importance of this to emergency planning and response is that damages can be expected to be spread over a much greater area, and an earthquake's location does not have to be close to a point to cause damage. Brick buildings on this substrate, because of their brittle nature, are subject to damage unless they are reinforced. Buildings not attached to their foundation are also especially vulnerable. Historical records show that post and beam structures built upon any medium are especially stable because of their inherent flexibility.

An earthquake with a magnitude greater than 6.5 would produce an emergency that would be comparable to that produced by a tornado or hurricane. In addition, bridges and dams would likely fail, and fuel storage tanks and water and gas mains would probably rupture. Strong earthquake motion on the sea floor near New Hampshire can generate tsunamis (tidal waves) that could produce damage and risk to life along the coastline.

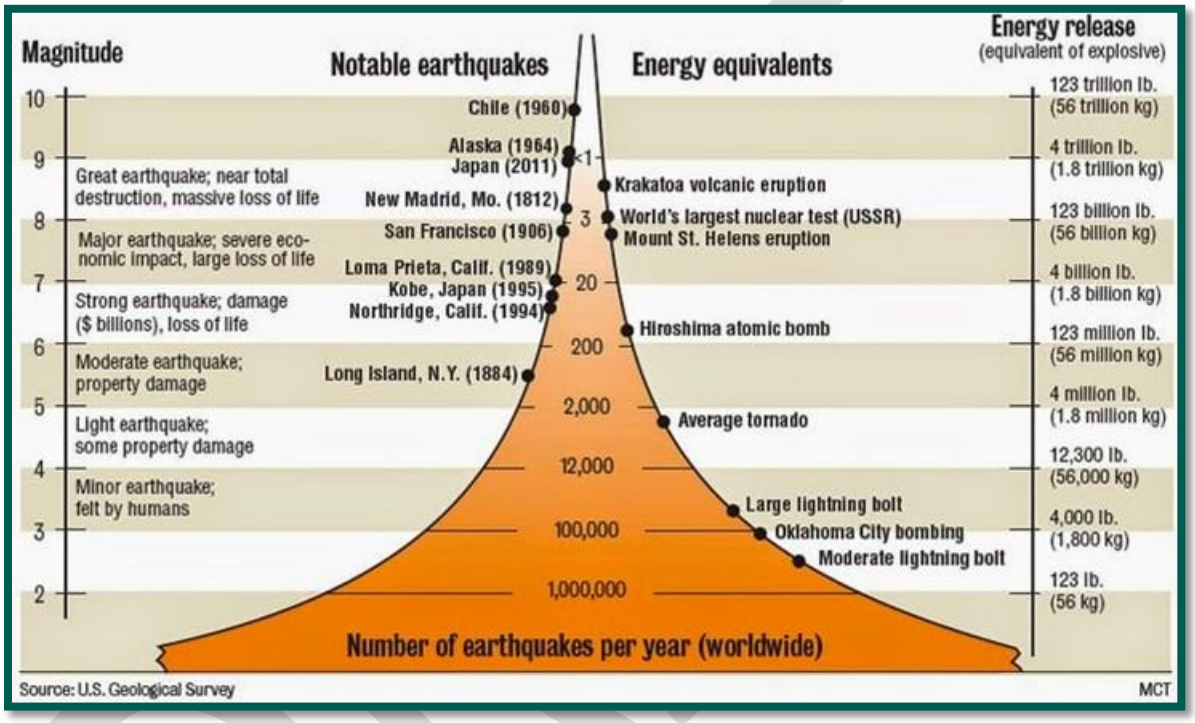
No warning system for earthquakes is presently possible for New Hampshire, but seismometers constantly record activity.

Extent:

The extent of earthquakes is expressed in terms of the magnitude (the size of the earthquake) and the intensity (measure of the shaking and damage, which can vary from location to location). One of the first scales developed to express the extent of earthquakes was the Modified Mercalli Intensity Scale. This

[94] https://www.des.nh.gov/organization/commissioner/pip/factsheets/geo/documents/geo-3.pdf

scale was a subjective intensity measurement of how an earthquake felt to people but could not provide a scientific comparison between earthquakes (based upon historical documents that information was able to be converted to MMI measurements). In the mid-1930s the Richter Scale, which measures earthquake magnitude, was developed and adopted as a logarithmic scale based on the amplitude of the seismic waves as measured on a seismograph at a standard distance. In the 1970s the Richter Scale was replaced by the Moment Magnitude Scale which captures all different seismic waves from an earthquake which allows for more precise measurement. An increase of 1 on the magnitude scale represents an earthquake that has 10x the energy than an earthquake of the previous magnitude.



Multi-scale depicting the magnitude of an earthquake and its associated energy. Significant earthquakes from across the world added for reference. *(Source: USGS)*

Modified Mercalli Intensity Scale		
Magnitude	Value	Description
1.0-3.0	I	Not felt except by a very few under especially favorable conditions.
3.0-3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
3.0-3.9	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0-4.9	IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
4.0-4.9	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0-5.9	VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

Magnitude	Value	Description
5.0-5.9	VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 and higher	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
6.0 and higher	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
7.0 and higher	XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
7.0 and higher	XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

Impacts:

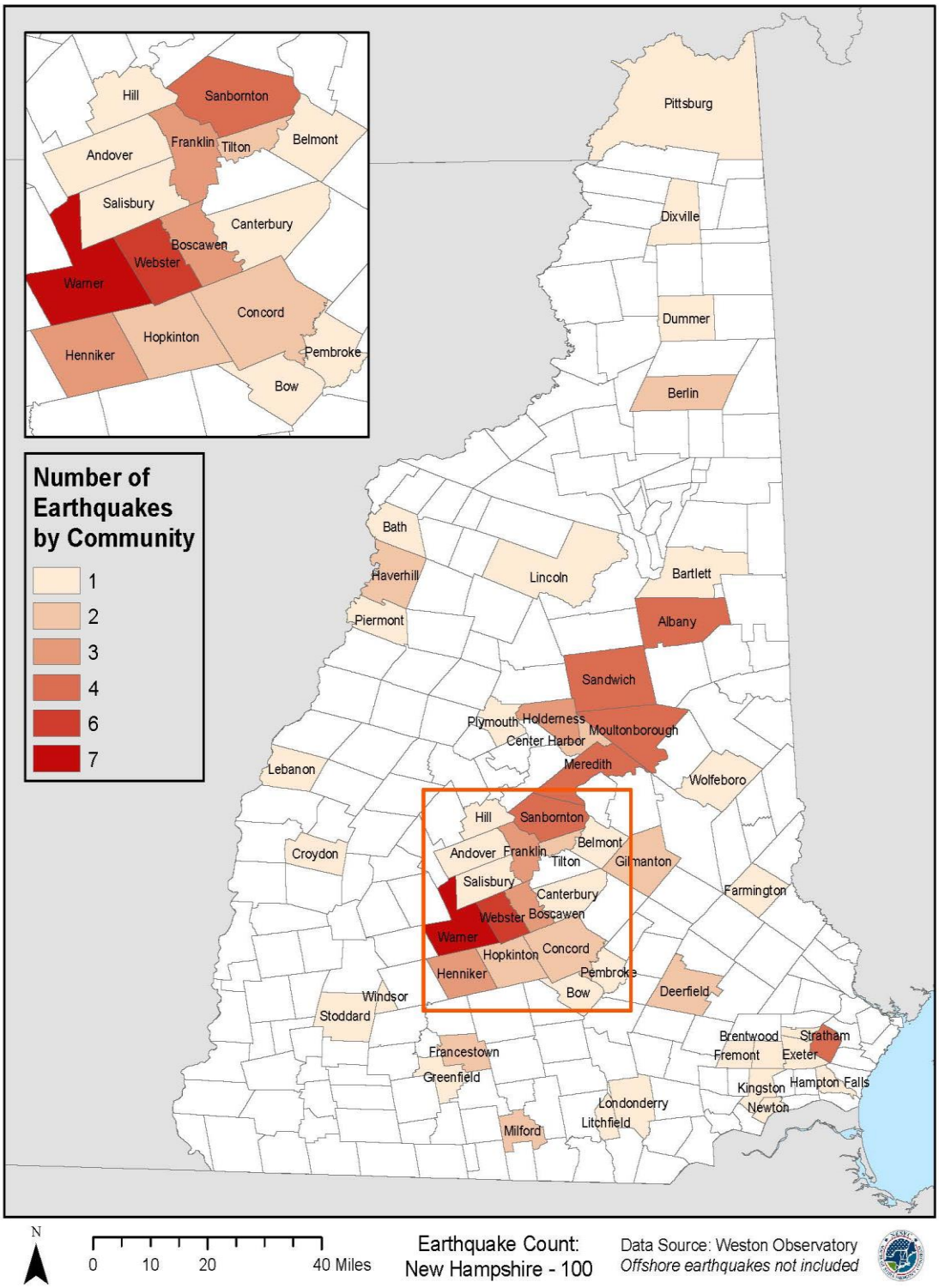
Magnitude and location of a damaging earthquake are the key factors in determining the possible impact as well as a cascade of disasters that may occur. Examples of potential and cascading impacts are below:

- Total or partial collapse of buildings, especially un-reinforced masonry structures and those not built to seismic codes
- Damage to roads and bridges from ground settlement and structural damage
- Mass casualties
- Loss of electric power
- Loss of telecommunication systems
- Total or partial loss of potable and firefighting water systems from pipe ruptures
- Hazardous material incidences
- Loss of critical capabilities from structural and nonstructural damages
- Lack of mutual aid support
- Damage to gas lines and chimneys result in fires that are difficult to extinguish due to damage to the roads and bridges, water systems, fire and police stations
- Structural and nonstructural damage cause many injuries; but, because of damage to health care facilities and emergency response facilities, there is a slow or nonexistent response
- Responders are slowed in their response because of hazardous material incidents
- Flooding due to dam failures

Previous Occurrences[95][96][97][98]:

Event Date	Magnitude	Impacts	Location	Additional Information
06/11/1638	6.5	Unknown	Central NH	The location and damage levels are very uncertain because settlements were sparse and reports were few. Shaking was felt strongly along the St. Lawrence River in Canada and in Boston. Aftershocks were felt for 20 days in Massachusetts.
10/29/1727	6.0-6.3	Damage to Structures	Off Coastline	Weekly News-Letter of Boston, MA described the event as ""The night after the last Lord's Day about 40 minutes after 10, in a calm & serene hour, the town was ... [suddenly] extremely surprised with the most violent shock of an earthquake that has been known among us. It came with a loud noise like thunder. The earth reel'd & trembled to a great degree. The houses rock'd & crackl'd as if they were tumbling into ruins. Many of the inhabitants were wakened out of their sleep, with the utmost astonishment: and others affrighted run into the streets for safety. Thro' the Goodness of GOD, the shock continued but about 2 or 3 minutes: and tho' some damage was done in the houses; yet none of the people received any bodily injury. For several times in the morning, there were heard some distant rumblings; and some fainter shocks were felt. But since that, the Earth, has been quiet; and tho' the minds of the people are yet greatly and justly affected."[99]
11/18/1755	5.8	Damage to Structures	Off Coastline	Cape Ann Earthquake
11/10/1810	4		Portsmouth	V MMI - was felt as far away as Boston, MA
07/23/1823	4.1		Off Hampton	IV MMI
12/19/1882	Unknown		Concord	V MMI
03/05/1905	Unknown		Lebanon	V MMI
08/30/1905	Unknown		Rockingham Cty.	V MMI
11/09/1925	4		Ossipee	VI MMI
03/18/1926	Unknown		New Ipswich	V MMI
11/10/1936	Unknown		Laconia	V MMI
12/20/1940	5.5-5.8		Ossipee	VII MMI - many chimneys were damaged, plaster was cracked, tombstones were rotated, some furniture was broken, and many items were thrown from shelves.[100]
12/24/1940	5.5-5.8		Ossipee	VII MMI
01/19/1982	4.0	Minor Damage	W of Laconia	This earthquake caused a chimney fire that destroyed one building, and it was felt strongly throughout central New Hampshire.
11/20/1988	4		5KM NE of Berlin	
04/06/1989	4.1		15KM NE of Berlin	
10/16/2012	4.7		SE Maine	VI MMI

[95] https://earthquake.usgs.gov/earthquakes/search/
[96] http://nesec.org/new-hampshire-earthquakes/
[97] https://pubs.usgs.gov/fs/fs-0006-01/fs-0006-01.pdf
[98] https://www.des.nh.gov/organization/commissioner/pip/factsheets/geo/documents/geo-3.pdf
[99] http://www.celebrateboston.com/disasters/boston-earthquake-1727.htm
[100] http://nesec.org/new-hampshire-earthquakes/



GIS diagram showing all New Hampshire earthquakes recorded from 2006-2016.. *(Source: Weston Observatory)*

Extreme Temperatures

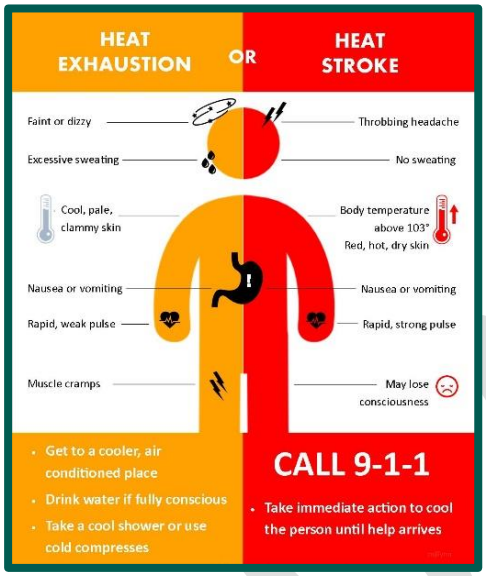
HIRA Risk: Low

Future Probability: High

Counties at Risk: All

Definition:

Extreme temperatures are a period of prolonged and/or excessive hot or cold that presents a danger to human health and life.



Heat exhaustion and heat stroke symptoms. *(Source- NOAA)*

Extreme Heat events occur as a result of above normal temperatures, which often coincide with high relative humidity, that increase the likelihood of heat disorders with prolonged exposure or strenuous activity. This risk comes from the heat and humidity preventing the human body from adequately cooling itself using natural methods; this can result in heat disorders and, if untreated, unconsciousness and eventually death. Heat related disorders include heat cramps, heat exhaustion, and heat stroke.[101] Populations at risk, such as the young and elderly, are more likely to experience a heat related disorder during a heat event. Humidity exacerbates how the human body experiences heat when hazy, damp air is trapped near the ground. Certain relative humidity percentages can render the body's natural ability to cool itself by sweating ineffective. These meteorological conditions can lead to heat stroke, which is an immediate medical emergency.[102] Extreme heat can also damage or kill crops and animals (wild, farm, or domesticated), potentially presenting a risk to the economy.

Extreme Cold events occur during meteorological cold waves, also known as cold snaps that are caused by the southern transport of arctic airmasses into the Northeast. These events are most common in winter months and increase the likelihood of cold disorders in humans and animals that have prolonged exposure to low ambient temperatures. This effect is exacerbated when there are winds present that effectively lower the temperature that is perceived by the human body, known as the wind chill. The risk comes from when the body is losing heat faster than it can produce it. Wind acts to carry heat away from the body, therefore amplifying the perceived temperature by the human body and reducing the body's core temperature. Cold disorders can include frostbite and hypothermia. Frostbite occurs when uncovered skin/extremities are exposed to extreme cold and the body tissue is either injured or killed. Hypothermia is when the body is unable to heat itself at the rate it is being cooled and the body's core temperature begins to drop below normal values. A normal core body temperature is considered to be 98.6°F: mild hypothermia occurs when core body temperature drops between 90-95°F and severe hypothermia occurs at core body temperatures of below 90°F. If left untreated, hypothermia can result

[101] http://www.nws.noaa.gov/om/heat/heat_index.shtml

[102] http://www.nws.noaa.gov/om/heat/heat-illness.shtml

in unconsciousness and eventually death. Extreme cold can also damage or kill crops and animals (wild, farm, or domesticated), potentially presenting a risk to the economy.[103][104]

Location:

The entire State of New Hampshire is at risk for extreme temperatures. The hazard is very season dependent: summer months present the greatest hazard for extreme heat events, while winter months present the greatest threat of extreme cold.

It is not impossible for individuals to experience extreme heat or extreme cold related illnesses year-round. For example, during the summer it is possible for people to experience hypothermia if they are swimming or submerged in a body of water for a long period of time that is cooler than their body temperature.[105]

Water Temperature		Expected Time Before Exhaustion or Unconsciousness	Expected Time of Survival
(°F)	(°C)		
32.5°	0.3°	< 15 minutes	45 minutes
32.5–40°	0.3–4.4°	15 – 30 minutes	30 – 90 minutes
40–50°	3.3–10°	30 – 60 minutes	1 – 3 hours
50–60°	10–15.6°	1 – 2 hours	1 – 6 hours
60–70°	15.6–21.1°	2 – 7 hours	2 – 40 hours
70–80°	21.1–26.7°	3 – 12 hours	3 hours – indefinite
> 80°	> 26.7°	Indefinite	Indefinite

Water temperature and associated survival times. *(Source-The Personal Flotation Device Manufacturers Association)*

Background and evolving hazard information:

A recent study by the New Hampshire Department of Health and Human Services, Division of Health and Human Services, explored heat and its effects on health on 15 New England communities within New Hampshire, Rhode Island, and Maine[106]. Heat index is a combined measure of heat and humidity that reflects what the weather feels like to the human body. High humidity values create conditions that feel warmer than the ambient air temperature during hot weather because the humidity reduces the body's effectiveness to cool down by sweating. This is due to the fact that the hot, humid airmass does not readily accept additional moisture, so the moisture that collects on the body by sweating does not evaporate. It is this evaporation of sweat that allows the body to cool. With this information in mind, the study found that emergency department visits and deaths increase by 7.5 and 5.1 percent, respectively, on days when the heat index reached 95 degrees when compared to data from days with a maximum heat index of 75 degrees. This new study is the first of its kind to relate heat and health in New England. The s\State epidemiologist indicated that the data showed increased impacts to public health on days with a heat index greater than or equal to 95 degrees and highlighted the enhanced risk to vulnerable populations, such as seniors, young children, and people with chronic health conditions.

Currently, New Hampshire experiences between two and ten days per year where the heat index reaches 95 degrees. According to Climate Solutions at the University of New Hampshire, it is predicted that the number of days per year where the heat index is over 95 degrees will increase by 12 days in northern New Hampshire and 22 days in southern New Hampshire by the year 2070. As a result of this information and the findings of the study, the National Weather Service (NWS) elected to lower the threshold for issuing heat advisories in December 2016. Due to the State's relatively low yearly average temperatures, New Hampshire residents are not as acclimatized to heat as people in other areas of the Country, and are therefore not as prepared to deal with its effects. Additionally, New Hampshire

[103] http://www.nws.noaa.gov/om/cold/index.shtml
[104] https://www.travelers.com/resources/workplace-safety/stay-warm-during-severe-cold-weather.aspx
[105] http://www.seagrant.umn.edu/coastal_communities/hypothermia
[106] https://www.ncbi.nlm.nih.gov/pubmed/28499499

citizens, and many other New England residents, do not have air conditioning in their homes and/or do not have the means to escape heat conditions when they occur. It is the hope of the study participants, New Hampshire HSEM, the NWS, and State stakeholders that the lowering of the Heat Advisory threshold will prompt New Hampshire residents to begin preparing for extreme heat events at lower temperatures to avoid the need for medical intervention and reduce the heat related mortality rate. [107]

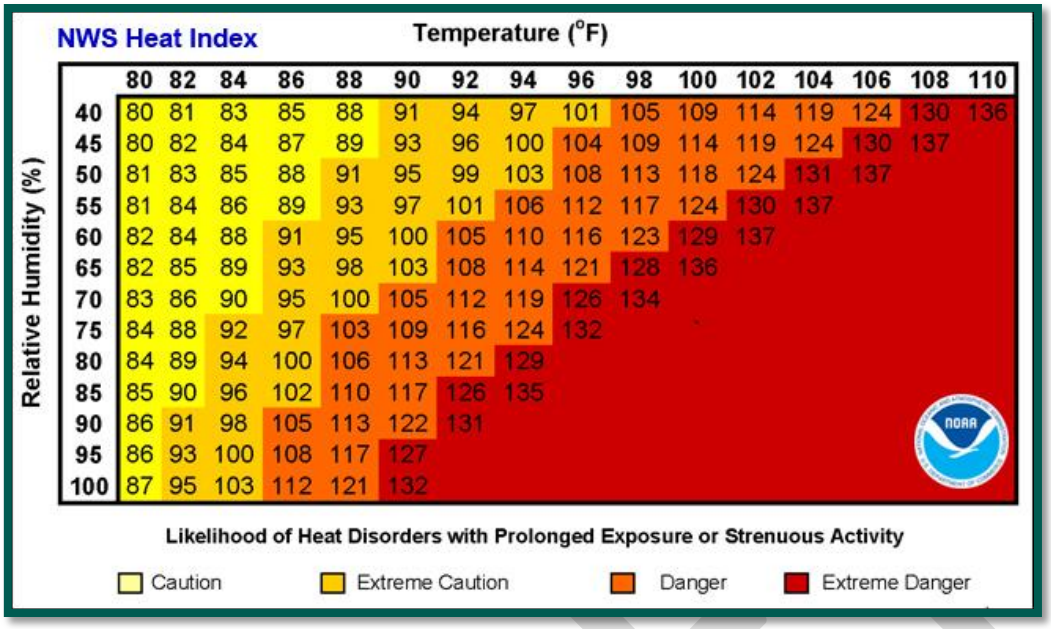
Extent:

Since temperatures, humidity, and wind are all based upon existing scientific scales (Fahrenheit, Relative Humidity % [comparison of ambient temperature and dew point], and miles per hour [or knots], respectively), the data is already comparative to each other. Severity/magnitude of these events relates to how extreme the temperature is, how long it is expected to remain at an extreme, and any exacerbating factors (such as humidity or wind). The National Weather Service has created charts and alert criteria to signal when temperatures are extreme:

Extreme Heat (excerpted from the National Weather Service)[108] Note: Some of these values are specific to the Northeastern Forecast Region—New Hampshire is located in this area.

- Heat Advisory—Two or more consecutive hours of Heat Index values of 95-99 degrees Fahrenheit for two or more days *OR* any duration of Heat Index values of 100-104 degrees Fahrenheit. A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions.
- Excessive Heat Warning—Two or more hours with Heat Index values of 105 degrees Fahrenheit or greater. An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions.
- Excessive Heat Watches—Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
- Excessive Heat Outlooks—Issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead-time to prepare for the event.

[107] https://www.dhhs.nh.gov/media/pr/2017/05102017-heat-index-study.htm
[108] http://www.nws.noaa.gov/om/heat/ww.shtml



[109]

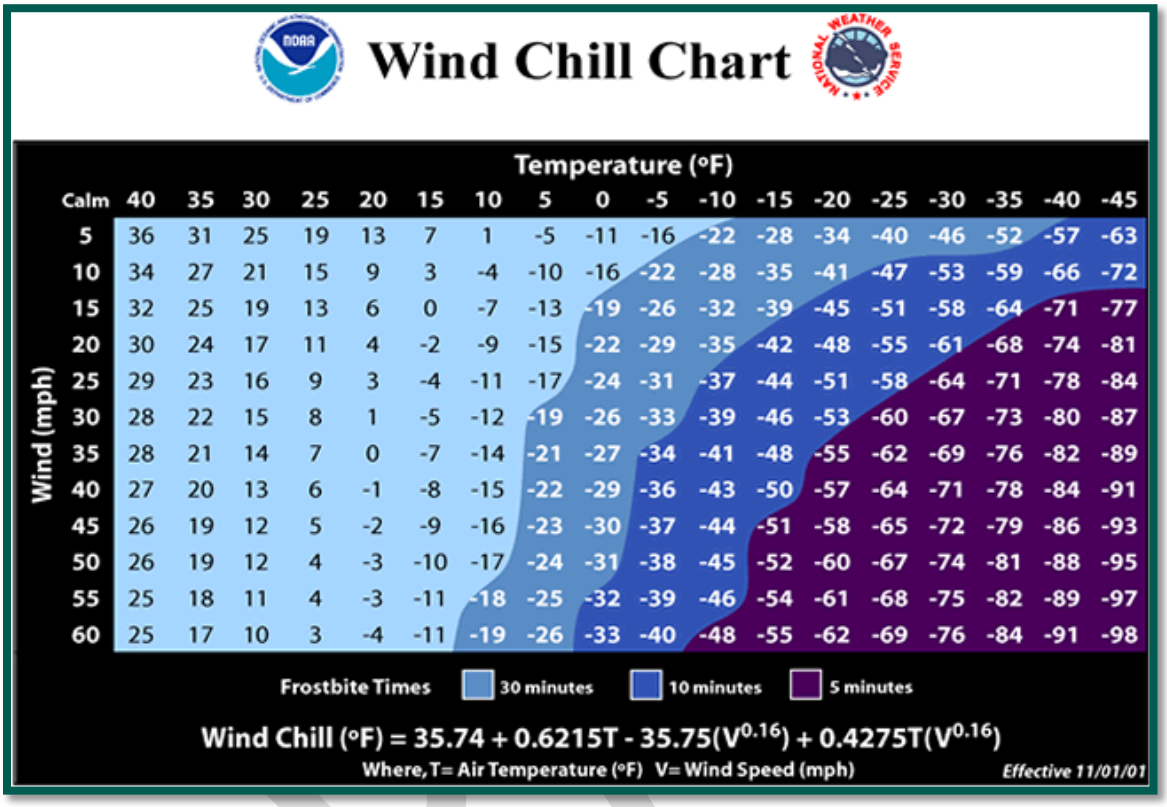
Heat index chart. *(Source-NOAA)*

Extreme Cold (excerpted from the National Weather Service)[110] *Note: Some of these values are specific to the Northeastern Forecast Region—New Hampshire is located in this area.*

- Wind Chill Watch: NWS issues a wind chill watch when dangerously cold wind chill values are *possible*. As with a warning, adjust your plans to avoid being outside during the coldest parts of the day. Make sure your car has at least a half a tank of gas, and update your winter survival kit.
- Wind Chill Advisory: NWS issues a wind chill advisory when seasonably cold wind chill values but not extremely cold values are expected or occurring. Be sure you and your loved ones dress appropriately and cover exposed skin when venturing outdoors. A Wind Chill Advisory is issued for New Hampshire is wind chill values are expected to be -20°F to -29°F and winds are greater than 5 mph.
- Wind Chill Warning: NWS issues a wind chill warning when dangerously cold wind chill values are expected or occurring. A Wind Chill Advisory is issued for New Hampshire is wind chill values are expected to be -30°F and winds are greater than 5 mph.
- Freeze Watch: NWS issues a freeze watch when there is a potential for significant, widespread freezing temperatures within the next 24-36 hours. A freeze watch is issued in the autumn until the end of the growing season and in the spring at the start of the growing season.
- Frost Advisory: Be Aware: A frost advisory means areas of frost are expected or occurring, posing a threat to sensitive vegetation.
- Freeze Warning: When temperatures are forecasted to go below 32°F for a long period of time, NWS issues a freeze warning. This temperature threshold kills some types of commercial crops and residential plants.

[109] http://www.nws.noaa.gov/om/heat/heat_index.shtml
[110] http://www.nws.noaa.gov/om/cold/ww.shtml

- Hard Freeze Warning: NWS issues a hard freeze warning when temperatures are expected to drop below 28°F for an extended period of time, killing most types of commercial crops and residential plants.



Wind Chill Chart

Wind (mph) \ Temperature (°F)	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10		34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15		32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20		30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25		29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30		28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35		28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40		27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45		26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50		26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55		25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60		25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Frostbite Times: 30 minutes | 10 minutes | 5 minutes

$$\text{Wind Chill (°F)} = 35.74 + 0.6215T - 35.75(V^{0.16}) + 0.4275T(V^{0.16})$$

Where, T= Air Temperature (°F) V= Wind Speed (mph) Effective 11/01/01

[111]

Wind chill chart. *(Source-NOAA)*

Impacts:

Extreme Heat[112]

- Health Impacts
  - Risk of heat related injury or death to humans, pets, and livestock
  - Particular risk to the elderly, especially those who do not have air conditioning
  - Risk to other individuals with functional needs
  - Risk to individuals who work outdoors or who already work in hot environments
- Transportation Impacts
  - Highway and road damage
    - Asphalt roads soften
    - Concrete roads can explode
  - Cars and Trucks
    - Increased stress on vehicle cooling systems
    - Increase potential for mechanical failure
    - Refrigerated goods experience a significantly greater rate of spoilage

[111] http://www.nws.noaa.gov/om/cold/wind_chill.shtml
[112] http://sciencepolicy.colorado.edu/socasp/weather1/adams.html

    - Rail
        - Increased on locomotive cooling systems
        - Train Rails may develop kinks and distort
    - Air
        - Aircraft lose lift at high temperatures (The airport in Phoenix Arizona has, in the past, closed or restricted certain aircraft [such as CRJs] from taking off or landing due to heat. This can affect people going to or coming from the Manchester / Boston Area as it is a major air carrier's hub)
- Agriculture
    - Livestock and birds can be severely impacted and killed
    - Milk production and cattle reproduction also slows down during heat waves
    - Crop production can be slowed, damaged, or destroyed during extreme heat events
- Energy
    - The demand for electricity increases because of more air conditioning and more power required by components
    - Demand on electricity heats up power lines causing transmission and distribution lines to sag
    - Sagging powerlines can short out causing power outages and brownouts
- Water Resources
    - The demand for water increases as a result of increased human and animal needs as well as the need for water to cool equipment and structures
    - The demand for water can also negatively impact firefighting operations due to lack of amount or pressure of water
    - Rise in water temperature can result in lower water quality and can affect fish populations and the death of other organisms

Extreme Cold[113]

- Health Impacts
    - Risk of cold related injury or death to humans, pets, and livestock
    - Particular risk to the elderly, especially those who do not have adequate heating sources or already live in cold buildings
    - Risk to individuals with functional needs
    - Risk to individuals who work or recreate outdoors
- Transportation
    - Vehicles, batteries, and fuels can become stressed and/or damaged
    - Roads and bridges can become damaged due to freezing or wind
- Agriculture
    - A freeze or frost early or late in the growing season can quickly become an agriculture disaster driving up the cost of product and economically impacting farmers
    - Livestock can be affected if not properly protected from cold temperatures
- Energy
    - Energy use can also rise significantly in extreme cold
- Water Resources

[113] http://sciencepolicy.colorado.edu/socasp/weather1/adams.html

- Extreme temperatures can freeze water resources, pipes, and systems, which not only stops people and animals from getting to water, but also can significantly damage water infrastructure

Previous Occurrences:

This table provides a snapshot of temperature records set in certain areas of the State. Extreme temperatures occur on a near annual basis across the State. That said, these events are tracked by the National Weather Service (NWS) only under certain circumstances. Extreme heat events are only logged into the NWS database when there is at least one fatality, and extreme cold is only recorded when the temperature or wind chill value is -35°F or lower. Furthermore, climatological data in New Hampshire is only reported select locations in the State of New Hampshire by the NWS office in Gray, Me. Due to these criteria, there is limited information available in the NWS online database for extreme temperature events in New Hampshire. The location description will say "statewide" even though the reporting location is generally the capital of Concord, as extreme temperature events tend to across the State and not at a single point.

Event Date	Event Description	Impacts	Location	Additional Information
July 1911	Heat Wave	Record high temperatures set in Concord, New Hampshire	Statewide	Extreme heat was recorded from July 3rd through July 5th, with high temperatures ranging from 101-102°F in Concord on these days.[114] These three days account for three of the top 10 hottest days on record for Concord, New Hampshire.
March 2012	Heat Wave	Record high temperatures set in Concord, New Hampshire	Statewide	High temperature records in Concord, New Hampshire were broken for 5 consecutive days, with the hottest day being 84°F.
September 2017	Heat Wave	High temperature records set across New Hampshire	Statewide	Mount Washington set record a daily high temperatures for four consecutive days. Manchester, Concord, and other areas across the State and New England also saw daily temperature records broken.[115]
December 2017	Cold Wave	Record low temperatures set across New Hampshire	Statewide	Record low temperatures were set across the State as a result of a cold wave. Portsmouth saw a low of -1°F and Mount Washington saw a low of -33°F (with a wind chill of -51°). Wind Chill Advisories were posted in central and southern New Hampshire, and Wind Chill Warnings were posted for northern New Hampshire.
February 2018	One Day Winter Heat Wave	High temperature records set across New Hampshire	Statewide	Exceptionally strong high pressure ridge in place across the Eastern Seaboard. Record high temperatures were broken across the State.[116]

[114] https://www.weather.gov/images/gyx/Climo/CONExtT.png
[115] http://www.concordmonitor.com/Mount-Washington-gets-record-high-temperatures-12764233
[116] https://www.washingtonpost.com/news/capital-weather-gang/wp/2018/02/21/this-weird-february-heat-dome-on-the-east-coast-could-be-unprecedented/?noredirect=on&utm_term=.9432172aba39

High Wind Events

HIRA Risk: High
Future Probability: High
Counties at Risk: All

Definition:

The State of New Hampshire experiences two types of high wind events that may result from other severe storms and may occur at any time of the year:

- **Tornadoes:** A tornado is a narrow, violently rotating column of air that extends from the base of a thunderstorm to the ground. Because wind is invisible, it is hard to see a tornado unless it forms a condensation funnel made up of water droplets, dust and debris. Tornadoes are the most violent of all atmospheric storms.[117]
- **Straight-line winds:** This term describes any thunderstorm wind that is not associated with rotation, and is usually used to differentiate from tornadic winds. There are several sub-types of straight-line winds[118]:
    - Downdraft – small-scale column of air that rapidly sinks towards the ground
    - Downburst – result of a downdraft, referred to as a macroburst when the area affected is greater than 2.5 miles and microburst when less than 2.5 miles.
    - Gust Front- leading edge of rain-cooled air that clashes with warmer thunderstorm inflow. Characterized by wind shift, temperature drop, and gusty winds in front of a thunderstorm
    - Derecho - widespread, long-lived wind storm that is associated with a band of rapidly moving showers or thunderstorms. A typical derecho consists of numerous microbursts, downbursts, and downburst clusters. By definition, if the wind damage swath extends more than 240 miles and includes wind gusts of at least 58 mph or greater along most of its length, then the event may be classified as a derecho.

Location:

The entire State is at risk for high wind events.

Background and evolving hazard information:

Although not typically thought of as an area that is susceptible to tornadic activity, the State experiences at least one confirmed tornado annually and numerous straight-line wind events each year. One of the earliest tornadoes occurred in September of 1821 when a tornado passed from the Connecticut River near the town of Cornish to the Town of Boscawen leaving 6 dead, hundreds injured, and thousands homeless. In 1998, an F2 tornado in Antrim blew down a large section of the Great Brook Middle School, and in 2008, another F2 tornado affected five counties in New Hampshire by downing trees, closing roadways, leaving 100 homes uninhabitable, cutting off phone and electric service to 12,500 customers, and killed one person when their home collapsed.

Firefighters checking for trapped occupants in Epsom after the 2008 EF2 Tornado
(Photo Credit - Jim Cole/Associated Press)

[117] http://www.nssl.noaa.gov/education/svrwx101/tornadoes/
[118] http://www.nssl.noaa.gov/education/svrwx101/wind/types/

Microbursts occur frequently in the State, more frequently than recorded as the National Weather Service only conducts high wind assessments to determine if a tornado occurred or not.

On September 6, 2011, a microburst occurred near 566 Route 3A impacting an RV distributor – multiple campers were picked up and blown into one another damaging 15 campers and causing $200,000 in damages.
(Photo Credit – Bow Emergency Management)

Extent:[119][120]

Tornadoes are measured based on the 3 second gust wind speed of the rotational winds. The Fujita Scale was developed at the University of Chicago in 1971 by Tetsuya Theodore Fujita in coordination with what is now known as NOAA's Storm Prediction Center to categorize each tornado by its intensity and estimated wind speeds. This scale is based off of the Beaufort scale and Mach Numbers. The Fujita scale was updated in 1973 and continued to be used for several more decades. Over the years the following weaknesses were identified in the Fujita Scale:

- Subjective based solely on the damage caused by tornado
- No recognition of different [building] construction
- Difficult to apply with no damage indicators (if ¾ mile wide tornado does not hit a structure, what F-Scale should be assigned?)
- Subject to bias
- Based on worst damage (even if only one building)
- Overestimates wind speeds greater than F3

Based on these weaknesses, the scale was updated in 2007 to what is now known as the Enhanced Fujita Scale (EF-Scale). The EF-Scale is now the standard scale for measuring tornadoes in the United States and in Canada.

Enhanced Fujita Scale	
EF Number	3 Second Gust (MPH)
0	65-85
1	86-110
2	111-135
3	136-165
4	166-200
5	Over 200

[119] http://www.spc.noaa.gov/efscale/
[120] https://www.weather.gov/cae/downburst.html

Downbursts are primarily based on their size, but consideration is also given to duration and wind speed.

Downbursts		
	Microburst	Macroburst
Size	Less than 2.5 Miles	Greater than 2.5 Miles
Duration	5-15 Minutes	5-30 Minutes
Wind speed (3 second gust - MPH)	up to 168 miles per hour	Damaging winds causing widespread damage, possibly as high as 134 mph[121]

Impacts:

All high wind events can result in significant damage to property and the environment as well as can represent a serious threat to personal safety as flying debris can cause serious bodily harm and/or death. Tornadoes, specifically, are assessed against 28 different damage indicators to classify the event.

Enhanced Fujita Scale Damage Indicators	
Number	Damage Indicator
1	Small barns, farm outbuildings
2	One- and two- family residences
3	Single-wide mobile homes
4	Double-wide mobile homes
5	Apt, condo, townhouse (3 stories or less)
6	Motel
7	Masonry apt or motel
8	Small retail building (fast food)
9	Small professional (doctor office, branch bank)
10	Strip mall
11	Large shopping mall
12	Large, isolated “big box” retail building
13	Automobile showroom
14	Automotive service building
15	School – 1 – story elementary (interior or exterior halls)
16	School – Jr. or Sr. high school
17	Low-rise building (1-4 story)
18	Med-rise building (5-20 stories)
19	High-rise building (over 20 stories)
20	Institutional building (hospital, government, or university)
21	Metal building system
22	Service station canopy
23	Warehouse (tilt-up walls or heavy timber)
24	Transmission line tower
25	Freestanding tower
26	Free standing pole (light, flag, luminary)
27	Tree – hardwood
28	Tree – softwood

[121] https://www.weather.gov/cae/downburst.html

Previous Occurrences:

Downburst Events

Event Date	Description	Impacts	Location	Additional Information
08/18/1991	Microburst	11 Injured, 5 killed, and nearly $2.4 Million in damages	Stratham	
07/26/1994	Microburst	Downed trees, utility poles and wires, 1,800 homes without power, and 50-60 homes damaged	Moultonborough	
07/06/1999	Macroburst	2 fatalities, 2 roofs blown off structures, downed trees, widespread power outages, and damaged utility poles and wires	Merrimack, Grafton, and Hillsborough Counties	
09/06/2011	Microburst	15 campers damaged, $200,000 in damages, 2,000 without power	566 Route 3A Bow	"Some of these things were pushed up to 60, 70, 80, 90 yards," said Lee Kimball of Bow Emergency Management. "Apparently, one got airborne and took out the three primary lines and snapped a pole before being dumped on the other side of the street."
07/04/2012	Microburst	Several large trees came down landing on homes or parked vehicles, 30 homes damaged and 12 people were sheltered at a local hotel	Tilton	
10/30/2012	Microburst	Several large trees came down, landing on two summer homes, completely demolishing one. No injuries were reported.	Franklin	
07/18/2016	Macroburst	Hundreds of trees were brought down closing numerous roads, thousands without power, significant property damage	Sweet Hill Road, Route 108, Forest Street and Red Oak Drive Plaistow	Wind event spread from Plaistow, New Hampshire to Cohasset, MA (~50 miles) according to the NWS in Taunton, MA
07/20/2017	Microburst	Dozens of trees blown down, thousands of people without power across multiple towns, multiple roads closed	Route 125 Barrington	

Tornado Events (Includes all events from 2013-2018, and all occurrences of EF 3 tornadoes)

Date	EF	Fatalities	Injuries	Width (Yards)	Length (Miles)	Affected Counties	Damage	Touch Lat	Touch Lon	Lift Lat	Lift Lon
6/9/1953	3	0	5	100	1.5	Rockingham	$5K-$50K	42.97	-70.97	Unk.	Unk.
5/20/1963	3	0	0	100	14	Cheshire, Hillsborough	$5K-$50K	42.9	-72.1	43.07	-71.93
8/20/1968	3	0	1	27	1	Hillsborough	$5K-$50K	43.1	-72.8	Unk.	Unk.
8/25/1969	3	0	0	17	5.7	Grafton	$5K-$50K	43.87	-71.7	43.95	-71.7
7/4/2014	0	0	0	10	0.36	Belknap	-	43.5868	-71.352	43.587	-71.344
7/24/2014	0	0	0	10	0.02	Belknap	-	43.687	-71.305	43.686	-71.304
7/30/2015	0	0	0	100	0.42	Merrimack	-	43.2866	-71.828	43.290	-71.822
7/18/2016	0	0	0	200	2.02	Coos	-	45.0685	-71.342	45.07	-71.301
5/4/2018	1	0	0	300	36	Sullivan and Merrimack	-	43.1594	-72.408	43.291	-71.729
6/18/18	0	0	0	25	9.45	Grafton		44.15	-72.00	41.10	-71.83
6/18/18	0	0	0	20	0.2	Grafton		11.08	-71.72	44.08	-71.72

Infectious Diseases
HIRA Risk: Low
Future Probability: Medium
Counties at Risk: All

Definition:
Infectious diseases are illnesses caused by organisms—such as bacteria, viruses, fungi or parasites. Many organisms live in and on our bodies. They're normally harmless or even helpful, but under certain conditions, some organisms may cause disease. Some infectious diseases can be passed from person to person, some are transmitted by bites from insects or animals, and others are acquired by ingesting contaminated food or water or being exposed to organisms in the environment. Signs and symptoms vary depending on the organism causing the infection, but often include fever and fatigue. Mild infections get better on their own without treatment, while some life-threatening infections may require hospitalization.[122]

According to the United States Centers for Disease Control and Prevention (CDC), the number of people with a disease that is usually present in a community is referred to as the baseline or endemic level of the disease. This number of infections is not necessarily the desired level, which may in fact be zero, but rather is the typical or normal number of people infected. In the absence of intervention and if the number of infections is not high enough to deplete the pool of susceptible persons, the disease may continue to occur at this level indefinitely. Thus, the baseline level is often regarded as the expected level of the disease. While some diseases are so rare in each population that a single case warrants an epidemiologic investigation (e.g., rabies, plague, polio), there are other diseases that occur more commonly so that only deviations from the norm (i.e. seeing more cases than expected) warrants investigation.[123]

Epidemics occur when an agent (the organism) and susceptible hosts are present in adequate numbers, and the agent can be effectively conveyed from a source to the susceptible people. More specifically, an epidemic may result from[37]:

- A recent increase in amount or virulence of the agent,
- The recent introduction of the agent into a setting where it has not been before,
- An enhanced mode of transmission so that more susceptible persons are exposed,
- A change in the susceptibility of people's response to the agent, and/or
- Factors that increase exposure or involve introduction through new portals of entry.

Epidemics may be caused by infectious diseases, which can be transmitted through food, water, the environment or person-to-person or animal-to-person, and noninfectious diseases, such as a chemical exposure, that causes increased rates of illness. Infectious diseases that may cause an epidemic can be broadly categorized into the following groups:

- Foodborne (Salmonellosis, E. Coli)
- Water (Cholera, Giardiasis)
- Vaccine Preventable (Measles, Mumps)
- Sexually Transmitted (HIV, Syphilis)

[122] Mayo Clinic Infectious Diseases Definition
[123] https://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson1/section11.html

- Person-to-Person (TB, meningitis)
- Arthropod borne (Lyme, West Nile Virus)
- Zoonotic (Rabies, Psittacosis)
- Opportunistic fungal and fungal infections (Candidiasis)

An epidemic may also result from a bioterrorist event in which an infectious agent is released into a susceptible population, often through an enhanced mode of transmission, such as aerosolizing (inhalation of small infectious disease particles).

Regarding foodborne and waterborne outbreaks, the epidemic hazard involves the safety of the food supply. This food safety may be jeopardized because of a fire, flood, hurricane, earthquake, or other natural, technological or human-caused disaster.

Location:
The entire State of New Hampshire is at risk for Infectious Diseases. The prevalent diseases can change based on the time of year, such as the influenza virus in the winter and foodborne disease in the summer.

Background and evolving hazard information:
Every year New Hampshire experiences a variety of outbreaks, some of which lead to an epidemic. In 2012, for example, an acute care hospital in New Hampshire experienced a large outbreak of Hepatitis C virus infections. The outbreak was caused by a Hepatitis C virus-infected healthcare worker that diverted narcotic medications in a way that put patients at risk for acquiring his infection. Food borne outbreaks are also common in New Hampshire and, on average, occur 5-10 times each year. Others that regularly occur in New Hampshire include outbreaks and/or epidemics of gastrointestinal illness, respiratory illness, and rash. The causal agent often differs, and the severity of the outbreak is dependent on a variety of factors such as virulence of the agent, susceptibility of the population at risk, and the mode of transmission.

In 2016, the New Hampshire Department of Health and Human Services (NH DHHS) Division of Public Health Services (DPHS) was notified and responded to a total of 102 outbreaks: 73 gastrointestinal illnesses (5 of which were foodborne), 23 respiratory illnesses, and 6 other types of illness.

During the 2009 H1N1 pandemic between late April 2009 and February 2010, New Hampshire saw an elevated number of novel influenza A(H1N1)-related hospitalizations (754) and deaths (10). This was classified as a Category 1 pandemic by the World Health Organization.

Theoretically, New Hampshire's entire population is vulnerable to the hazard of an epidemic. However, epidemics often occur among a specific age group or a group of individuals with similar risk factors and types of exposure. For example, the Hepatitis A epidemic of 2005 occurred primarily among the illicit drug using population. Similarly, Pertussis (whooping cough) outbreaks most often occur among school-aged children. Many times, congregate settings, such as child-care facilities and schools, offer the opportunity for increased person-to-person transmission because of the proximity of individuals within those settings.

Outbreaks where the source is contaminated food are non-discriminatory and can affect any individual who eats the food. Bioterrorist events are also non-discriminatory in that the agents involved may cause illness in anyone exposed. Immuno-compromised individuals, such as the elderly, infants, or severely ill, are often at increased risk because their natural defenses to fight illness may be weakened. Some diseases occur seasonally, which allows minimal predictability in preparing for outbreaks and epidemics. For example, influenza most often occurs in the winter months while West Nile Virus occurs in the summer months. Therefore, appropriate resources may be designated for those applicable seasons.

Rates of illness, duration of disease, and the ability to treat or prevent illness once the causative agent is identified are just a few factors that will further determine the vulnerability of the population. Epidemics have the potential to cause a significant loss of life and/or widespread illness throughout the State. The threat of a pandemic influenza exemplifies a devastating situation where there may be an extreme shortage of essential service workers, a rapid transmission of disease from person-to-person, and no effective vaccination to prevent the illness. Additional vulnerabilities that may influence the NH DHHS response to an epidemic include those within the Food Protection Section (FPS), the New Hampshire Public Health Laboratories (PHL), and the Bureau of Infectious Disease Control (BIDC). Each of these units may have specific vulnerabilities that can be categorized into three main areas: staffing, equipment and supplies. However, each unit has also developed specific skills or capacities to respond to and mitigate a potential threat or event given these potential gaps.

During the 2009 H1N1 pandemic, an enormous strain was placed on resources within the Division of Public Health Services, including personnel, equipment (i.e., laboratory), and office supplies. During this time frame, the demand for flu testing by the New Hampshire Public Health Laboratories significantly increased. A total of 4,192 specimens were tested by PCR laboratory testing, which resulted in 786 confirmed cases of novel H1N1 infections. The demand for testing was so high that the PHL eventually needed to limit the specimens it would accept to a narrower subset of ILI cases, which included hospitalized patients, healthcare workers, patients of ILINet providers, or persons who were part of a respiratory outbreak investigation. A moderate influenza pandemic would also put an enormous strain on the broader public health and health care system throughout New Hampshire.

Extent:

The magnitude and severity of infectious diseases is described by its speed of onset (how quickly people become sick or cases are reported) and how widespread the infection is. Some infectious diseases are inherently more dangerous and deadly than others, but the best way to describe the extent of infectious diseases relates to the disease occurrence[124]:

- Endemic – Constant presence and/or usual prevalence of a disease or infection agent in a population within a geographic area
- Hyperendemic – The persistent, high levels of disease occurrence
- Cluster – Aggregation of cases grouped in place and time that are suspected to be greater than the number expected even though the expected number may not be known
- Epidemic – An increase, usually sudden, in the number of cases of a disease above what is normally expected
- Outbreak – The same as epidemic, but over a much smaller geographical area

[124] https://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson1/section11.html

- Pandemic – Epidemic that has spread over several countries or continents, usually affecting many people

Impacts:[125]

United Campus Ministry in Durham closed after a case of anthrax. *(Source- Jim Cole/Associated Press/NY Times)*

Public health incidents and infectious diseases may occur suddenly or with a slow onset. Incidents that occur suddenly may have extraordinary and/or overwhelming medical resource needs. Incidents may occur with a slow onset and/or with advance warning will allow for a more coordinated response. During sudden onset incidents, many victims may reach healthcare facilities on their own without the use of Emergency Medical Services (EMS), which means that victims may arrive to find unprepared or inadequate facilities.

Incidents may be insidious or obvious, and both have unique impacts. Insidious incidents (such as diseases that have a longer incubation/onset period where infection can be spread without knowing) can result in a much higher infection rate, eventually overwhelming existing medical resources and resulting in higher morbidity and mortality. Incidents that are more obvious are more recognizable and can result in a more accurate healthcare response, but this may also result in much higher social complications such as fear, anxiety, unnecessary social distancing. For example, the average person may be more afraid of Ebola than influenza; however, the latter is much more likely to occur in the US. Having proper surveillance systems to recognize public health and infectious disease incidents is critical to be able to limit impacts.

The duration of the incident can also cause unique impacts. In a short duration incident, there may be a medical surge at the beginning which tapers off as the incident goes on and may not result in significant disruption to everyday life. However, longer duration incidents may have significant impacts not only for the public health response, but also for business/industry and the economy.

Terrorism also has unique impacts when compared to an endemic infectious disease, as there is a significantly higher fear factor that causes increased emotional stress and anxiety. There will be a significant surge on healthcare, even by those who were unaffected, because of fear. This is in addition to any morbidity or mortality that occurs directly or indirectly from the attack. This was the case with the 1995 Tokyo subway sarin attack.

According to NH DHHS's 2007 Influenza Pandemic Public Health Preparedness and Response Plan, it is estimated that an influenza pandemic will cause nearly 16,000 hospitalizations and nearly 4,000 deaths.[126]

[125] https://www.phe.gov/Preparedness/planning/mscc/healthcarecoalition/chapter1/Pages/implications.aspx
[126] https://www.dhhs.nh.gov/dphs/cdcs/avian/documents/pandemic-plan.pdf

Previous Occurrences:

Event Date	Event Description	Impacts	Location	Additional Information
2005	Hepatitis A	82 cases	Statewide	82 cases were reported; 30% higher than previous four years.
2009	H1N1 Influenza	754 Hospitalizations and 10 Deaths	Statewide	WHO Level 1 Pandemic "swine flu" Division of Public Health Services processed 4,192 specimens and 786 cases.
2009	Anthrax	Individual infected with gastrointestinal anthrax	Durham	A woman was sickened by a naturally occurring strain of anthrax that was on an African drum she was playing in a community drumming circle.[127]
2012	Hepatitis C	32 patients infected with Hepatitis C virus, thousands tested and interviewed	Exeter Hospital	Patients became infected with Hepatitis C virus when a healthcare worker diverted injectable narcotics intended for patients.
August 2013	Hepatitis A	2 hepatitis A virus-infected foodservice workers, ~ 1,200 exposed people vaccinated	Contoocook	A part-time bartender at the American Legion and Covered Bridge Restaurant in Contoocook was diagnosed with Hepatitis A resulting in the potential exposure of patrons of those establishments resulting in two points of dispensing (PODs) being activated: the first in Hopkinton and the second, due to the occurrence of the Hopkinton Fair, was held in neighboring Bow.
Fall 2014	Enterovirus D-68	>40 ill children in New Hampshire, some with paralysis	Statewide	A rare strain of enterovirus resulted in debilitating infections in children nationwide
Fall 2014-Feb 2016	Ebola virus disease	>100 people in New Hampshire monitored for potential Ebola virus symptoms	Statewide	New Hampshire residents were monitored for symptoms of Ebola virus disease after travelling to West Africa during the unprecedented outbreak of Ebola virus. No actual cases of Ebola virus occurred in New Hampshire.
2016	Gonorrhea	465 people infected	Statewide	465 cases reported; 250% higher than previous years
2017-2018	Seasonal Influenza Outbreak	As of April 2018, 63 adult influenza related deaths had been identified in New Hampshire	Statewide	A particularly virulent flu season impacted the region. The overall effectiveness of the flu vaccine during this flu season was estimated at 36%.[128]
Annually	Foodborne outbreaks	Ill individuals associated with outbreaks	Statewide	5-10 outbreaks per year
Annually	Influenza and other respiratory virus outbreaks	Ill individuals associated with outbreaks	Statewide	25-50 outbreaks per year primarily occurring in long-term care facilities and schools
Annually	Norovirus and other gastrointestinal virus outbreaks	Ill individuals associated with outbreaks	Statewide	60-80 outbreaks per year primarily occurring in long-term care facilities and schools

Weekly statistics and technical influenza information for the State of New Hampshire is made available by NH DHHS here during flu season. Additionally, a five year infectious disease report provided by NH DHHS, Bureau of Infectious Disease Control can be found here. Find these and additional monitoring resources in the **RESOURCES APPENDIX.**

[127] http://www.nytimes.com/2009/12/30/us/30anthrax.html?mcubz=0
[128] https://www.cdc.gov/mmwr/volumes/67/wr/mm6706a2.htm

Landslide

HIRA Risk: Low
Future Probability: High
Counties at Risk: All

Definition:

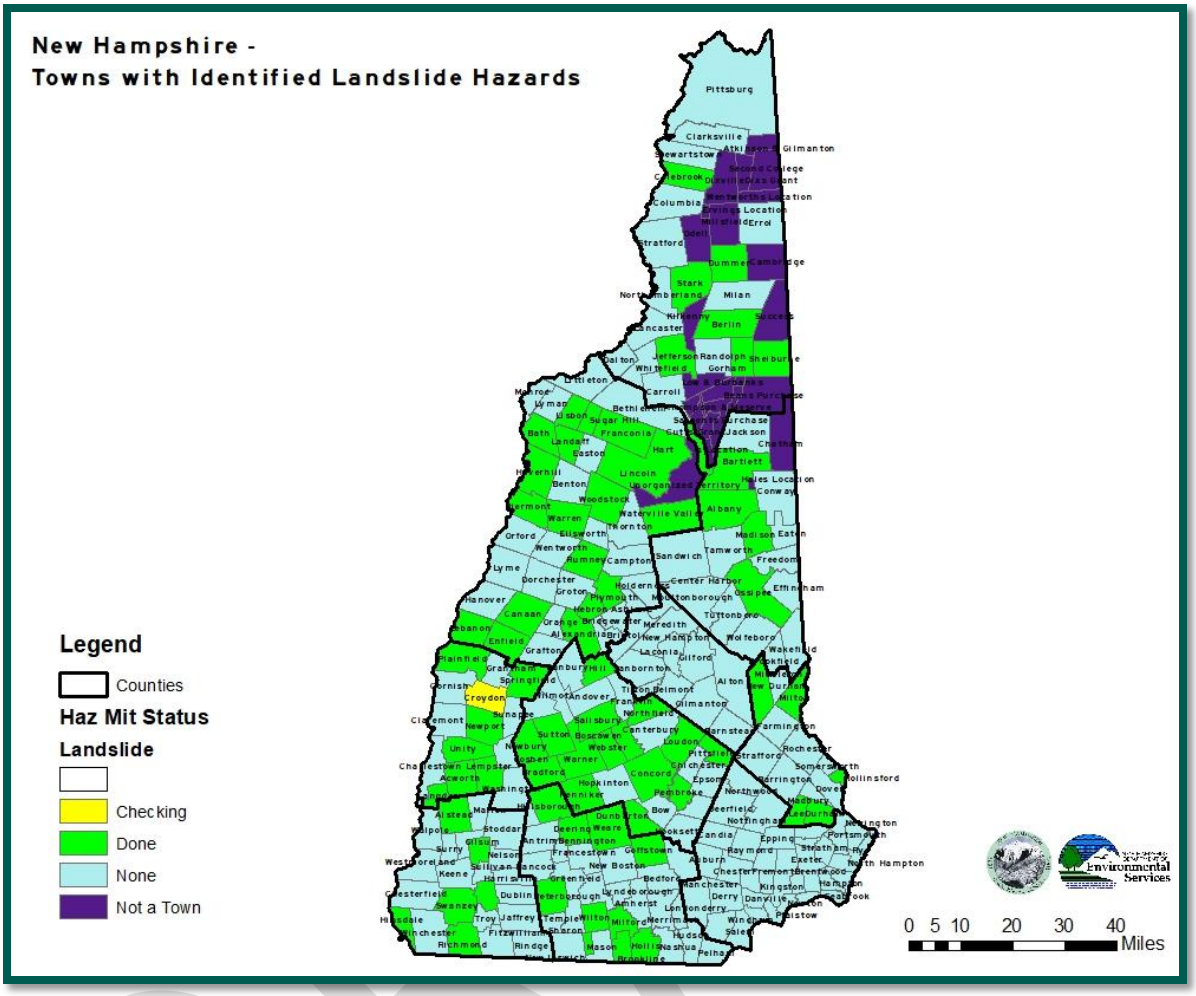
A landslide is the downward or outward movement of earth materials on a slope that is reacting to a combination of the force of gravity and a predisposed weakness in the material that allows the sliding process to initiate. The broad classification of landslides includes mudflows, mudslides, debris flows, rockslides, debris avalanches, debris slides and earth flows. Landslides may be formed when a layer of soil atop a slope becomes saturated by significant precipitation and slides along a more cohesive layer of soil or rock. Although gravity becomes the primary reason for a landslide once a slope has become weak through a process such as the one just described, other causes can include[129]:

- Erosion by rivers or the ocean that creates over-steepened slopes through erosion of the slope's base. In the case of rivers, this can occur as a result of flash flooding.
- Rock and soil slopes are weakened through saturation by snowmelt or heavy rains
- Earthquake creates stress that makes weak slopes fail—earthquakes of 4.0 magnitude and greater have been known to trigger landslides
- Wildfires (loss of vegetation)
- Excess weight from accumulation of rain or snow, stockpiling of rock or ore, the formation of waste piles, or building of man-made structures may stress weak slopes to the point of failure

Location:

Steep slopes are located throughout the State of New Hampshire, except in areas near the immediate coast. These slopes are at risk for landslides. Local hazard mitigation plans contain information about specific landslide risks within towns throughout the State. However, a completed compilation of such information is not yet contained in a statewide geodatabase. The New Hampshire Geological Survey, a part of NHDES, began undertaking the task of assembling individual town landslide information into a statewide geodatabase during late-2017 with the goal of allowing greater precision in identifying locations of landslide risk. This information was derived from formally approved local hazard mitigation plans. Once complete, this developed inventory could be used by geologists, engineers or geotechnicians to identify locations to conduct further, more detailed geotechnical analysis in the future. Below is a graphic of the work that is currently in progress. Areas in green indicate that the location has one or more landslide occurrences (or potential occurrences) noted in their local hazard mitigation plan. The grey-blue color indicates that the local hazard mitigation was reviewed and no instances of landslides were identified. Yellow indicates locations where the local hazard mitigation plan is still under review for this information.

[129] https://landslides.usgs.gov/learn/ls101.php



A geospatial map of towns identified to have landslide hazards identified in their formally approved local hazard mitigation plans (as of March, 2018). This project is an initiative of New Hampshire Geological Survey. *(Source: NHDES)*

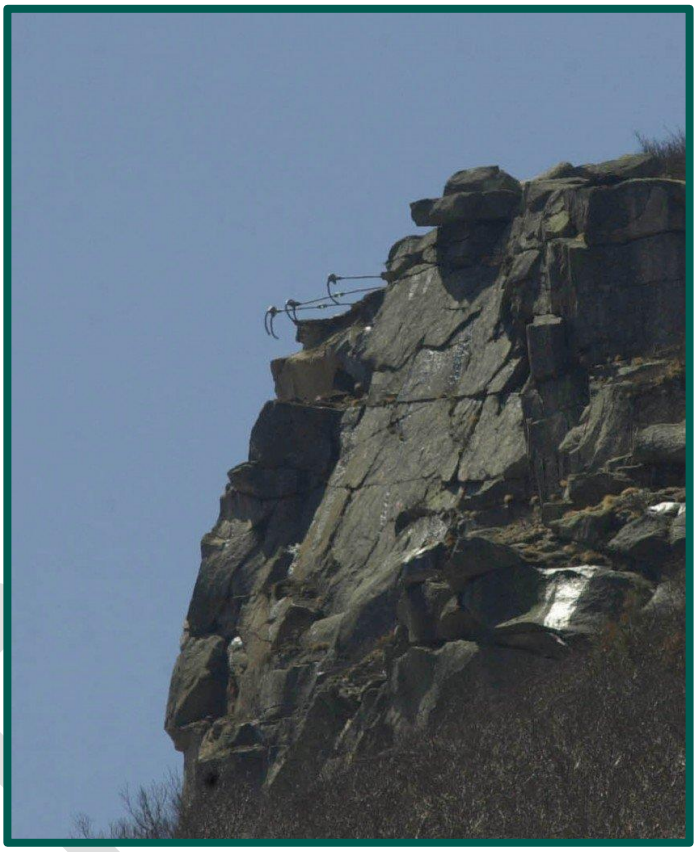
Background and evolving hazard information:

In New Hampshire, the greatest potential for landslide hazards exists in the White Mountains, where steep slopes and marginal soils occur in abundance. Many notable landslides have occurred in the region in the past, including the Willey Slide in 1826. Nine people were killed in that event. New Hampshire's other fatal landslide at Cherry Mountain in 1885 killed one person. Seven major landslides have occurred in Crawford Notch in the 20th century, with six of these causing damage to roads. In April 2006, a mudslide approximately 20 feet high and 40 feet wide significantly damaged one home and threatened others in Hooksett Village. The damaged home was sited at the foot of a steep bank of glacial lake clays, which line the Merrimack River valley. In March 2010, a landslide occurred adjacent to the Souhegan River in Greenville, which closed High Street. Also in 2010, a landslide occurred adjacent to four homes atop a bluff beside the Cocheco River on Wilson Street in Rochester. Another landslide, induced through overtopping of an undersized culvert at the top of a hill, occurred on Slayton Hill Road in Lebanon in July 2013.

The potential for property damage resulting from landslide activity remains significant. Areas of New Hampshire most threatened by landslides include much of the rugged terrain of the White Mountains and Connecticut River Valley. The threat of landslides in the Connecticut River Valley owes to its unique glacial geologic history. As the last continental glacier receded from the region at the end of the Pleistocene epoch approximately 15,000 years ago, a large glacial lake flooded the Connecticut River Valley as a newly formed glacial ridge impounded drainage to the south in Connecticut. The thick deposits of silt and clay that underlay much of the Connecticut River Valley were deposited beneath the quiet waters of this lake. These deposits are noted for the presence of thin alternating light colored and dark colored centimeter-scale layers called varves, with each pair of layers thought to represent one year of deposition in the glacial lake.

Warning signs are often present prior to a large event. Ground cracks, bulging, and slumping may develop in the years prior to a slide event. Foundations in nearby homes may shift significantly and require major repairs. Wetlands surfaces may rise and fall.

The Old Man of the Mountain, the enduring symbol of the State of New Hampshire, no longer exists due to a rockslide. Sometime between the evening of Friday May 2, 2003 and the morning of Saturday May 3, 2003, the stone profile that drew hundreds of thousands of visitors to Franconia Notch State Park each year collapsed. On Saturday, May 3rd at approximately 7:30am, two Franconia Notch State Park Employees noticed that that the Old Man of the Mountain had collapsed. The cause is believed to be continuous action of freezing and thawing of the moisture that had invaded the rock's fissures causing them to expand and contract.



Before and After Pictures taken by The Associated Press in 2001 and 2003 respectively – in the right picture the turnbuckles used to secure the Old Man are visible as the 40' structure has disappeared.

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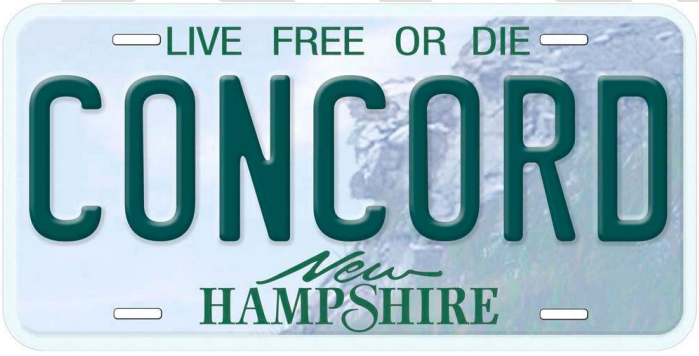
This is perhaps the most well-known landslide in New Hampshire's History due to the deep rooted uniqueness of this naturally occurring rock formation. Images of the Old Man of the Mountain can still be found on items such as license plates and currency.



[130] http://www.pressherald.com/2013/04/08/ceremony-to-mark-10th-anniversary-of-nhs-old-man/

Extent:
While no universally accepted standard or scientific scale has been developed for measuring the severity of all landslides, severity can be measured several other ways:

- Steepness/grade of the Slope (measured as a percent)
- Geographical Area
    - Measured in square feet, square yards, etc.
    - More accurately measured using LiDAR/GIS systems
- Earthquake, either causing the event or caused by the event (measured using the Moment Magnitude Intensity or Mercalli Scale)

There are also multiple types of landslides[131]:

- **Falls:** A mass detaches from a steep slope or cliff and descends by free-fall, bounding, or rolling
- **Topples:** A mass tilts or rotates forward as a unit
- **Slides:** A mass displaces on one or more recognizable surfaces, which may be curved or planar
- **Flows:** A mass moves downslope with a fluid motion. A significant amount of water may or may not be part of the mass

Like flooding, landslides are unique in how they affect different geographic, topographic, and geologic areas. Therefore, consideration of a multitude of measurements is required to determine the severity of the landslide event.

Impacts:
The primary impacts of a landslide are the damage and destruction to property and infrastructure located in the area that the landslide occurred. The land material moved during a landslide can cause damage to roads, buildings, and infrastructure at the base of the slope on which the landslide occurred. Buildings or infrastructures that are atop the slide, or on the side of the slope where the slide occurs, can be severely damaged or destroyed through its consumption by the slide. The hazard of death and injury to individuals atop, on, or at the base of a slide exists if such individuals are present in those locations when the landslide occurs.

A change in topography or geology can also affect the flora and fauna as well as crops and farmland. Landslides that occur adjacent to a waterbody, such as a river or lake, can introduce excess sediment, increasing the turbidity of the receiving waterbody and impacting water quality if the quantity of sediment is of sufficient quantity. A very large landslide into a river could cause an obstruction that acts like a dam, creating an impoundment of water which leads to sediment and woody material deposition within it. This could also further create an additional risk of a "dam failure" at some future time when the natural dam breaks down, resulting a rapid release of the stored water from upstream.

[131] https://oas.org/dsd/publications/Unit/oea66e/ch10.htm

Previous Occurrences:

Event Date	Event Description	Impacts	Location	Additional Information
11/18/1755	Cape Ann Earthquake	Mass movement of landforms	Newcastle	
06/12-07/02/1998	Flood Event	Fatality due to Landslide	Unknown	A death occurred when an individual was caught in a landslide of mass soil due to flooding.
05/03/2003	Old Man of the Mountain	Rock formation representing the face of an "old man" which became a symbol synonymous with the State fell in a landslide event.	Franconia Notch	
05/14/2006	Mother's Day Flood	Thousands of dollars of property damage displacing a family for more than a week. Debris covered railroad tracks.	Bow	Debris and mud from an adjacent property caused thousands of dollars of damage to a property on Route 3A.
May and June 2006	Mother's Day Flood and June rain event	Two homes on Granite Street were evacuated due to landslides on a hill twice within one month	Hooksett	Moisture caused landslides[132]
10/17/2007	Snow Event	Route 101 blocked due to landslide	Wilton	[133]
03/31/2010	Landslide	High Street closed	Greenville	A landslide occurred on a steep slope adjacent to the Souhegan River pool in Greenville, High Street was located directly atop the slide, forcing its closure, with ground cracks directly adjacent to the road. A detour was required for school buses and traffic headed to New Ipswich. Engineered stabilization was required.
04/07/2010	Landslide	Backyards of four homes on Wilson Street slumped into the floodplain of the Cocheco River	Rochester	Landslide likely occurred through sliding of material against an interface layer between permeable sand and less permeable clay. During field surveys in 2016, water was observed seeping out of the exposed bank at this interface.
10/31/2012	Hurricane Sandy	Landslide and Fatal Landslide	Goffstown and Lincoln	An owner of a construction company was inspecting storm damage to a house foundation under construction when the foundation hole was filled with water and collapsed trapping the individual in a landslide of mud, water, and rocks down a two to three story high hill.[134] In Goffstown there was a landslide on Riverview Park Road adjoining the Piscataquog River.

[132] http://usatoday30.usatoday.com/weather/storms/2006-06-05-NH-flooding_x.htm
[133] https://www.youtube.com/watch?v=ujqUAelLpMA
[134] http://www.unionleader.com/apps/pbcs.dll/article?AID=/20121031/NEWS07/121039794/1013/news11

Event Date	Event Description	Impacts	Location	Additional Information
07/02/2013	Landslide	Landslide completely washed out Slayton Hill Road, with earth material entering the Meadowmere Housing development at the base of the slope	Lebanon	A thunderstorm with heavy rain caused a stream at the top of the hill on Slayton Hill Road south of the Mascoma River crossing to overtop an undersized culvert which conveyed the stream under the road. The water then flowed down Slayton Hill Road, completely washing out the road and its adjacent land, and depositing the material at the base of the slope just south of the Mascoma River, with earth material also traveling down the slope and entering the Meadowmere Housing development, causing damage.

Lightning
HIRA Risk: Low
Future Probability: High
Counties at Risk: All

Definition:
Lightning is a visible electric discharge produced by a thunderstorm. The discharge may occur within or between clouds, between a cloud and the air, between a cloud and the ground, or between the ground and a cloud.[135]

There are roughly 5-10 times as many cloud flashes as there are cloud to ground flashes. There are two types of ground flashes: negative polarity (those that occur because of electrification in the environment) and positive polarity (charge build up on tall structures, airplanes, rockets, and towers on mountains). Negative polarity lighting goes from cloud to ground while positive polarity lightning goes from ground to cloud.

Thunder always accompanies lightning, but may or not be heard depending on the position of the observer. As lightning passes through the air, it heats the air to a temperature of 18,000-60,000 degrees Fahrenheit. This causes the air to rapidly expand and contract creating a sound wave known as thunder. Thunder can be heard up to 10 miles away from the strike. At longer distances thunder sounds like a low rumble as the higher frequency sounds are absorbed by the environment.[82]

Location:
The entire State of New Hampshire is at risk for lightning; areas at enhanced risk include tall buildings, areas of higher elevation, sporting arenas, open bodies of water, large fields, and campgrounds with sparse tree coverage. Negatively polarity lightning (cloud to ground) usually occurs in the immediate area of the storm, whereas positive polarity lightning (ground to cloud) can strike long distances around the cell when no immediate signs of a thunderstorm are present. Some lightning strikes occur far outside of the parent thunderstorm—these are called "bolts from the blue", as they appear to come from a clear sky. These strikes are much more dangerous because they can strike up to 25 miles outside of the storm, catching people off guard in what appears to be clear conditions.

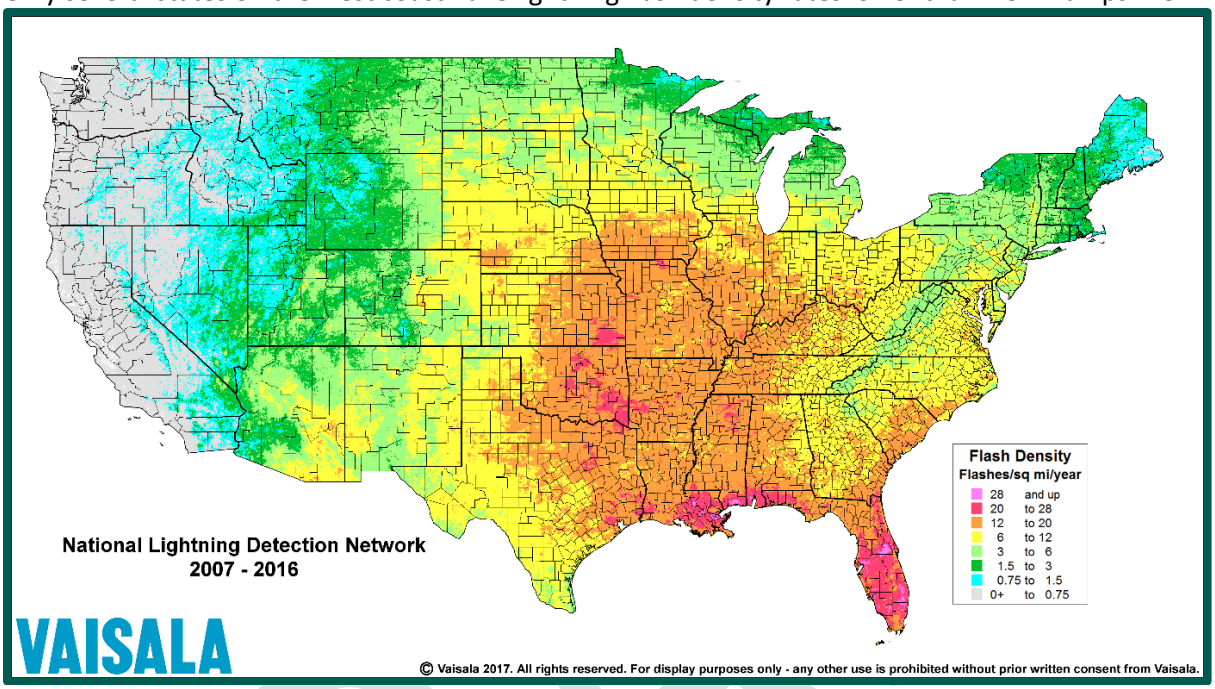
Background and evolving hazard information:
Lightning is one of the oldest observed weather phenomena on earth. Lightning is most commonly associated with thunderstorms; however, lightning can also occur during extremely intense forest fires, strong convective snowstorms, surface nuclear detonations, and during volcanic eruptions.[82] Lightning is a natural and necessary phenomenon which helps maintain the earth's natural electrical balance.

Lightning can have different color characteristics depending on environmental factors such as haze, dust, moisture, and raindrops. Lightning is usually described as white or blue; however, it can also be described as pink or green when lightning occurs during a snowstorm. [136]

[135] http://www.lightningsafety.noaa.gov/science/science_thunder.htm
[136] https://www.nssl.noaa.gov/education/svrwx101/lightning/faq/

Lightning strikes the ground in the United States approximately 25 million times per year. The chance that a lightning strike could injure or kill a person during any given year is one in 240,000.

The State of New Hampshire does not experience lightning as often as most other areas of the Country. Only several states on the west coast have lightning flash density rates lower than New Hampshire[137].



Despite the relatively low incident of lighting in New Hampshire, the State has a relatively high injury rate due to lightning. The high risk in comparison to frequency of lightning events is due to the activities that citizens and guests of the State partake in. On warm summer days when lightning is most likely to occur, people are outside enjoying the variety of recreational activities that attract people to northern New England such as hiking, biking, swimming, boating, golfing, etc. – all activities which leave individuals vulnerable during a lightning storm. Lightning is most common in New Hampshire during the summer months when there is more instability and moisture in the atmosphere. Lightning during winter months is extremely rare, but has been observed. Referred to as thundersnow, lightning during snowstorms is possible under uncommon meteorological conditions where a strong instability and abundant moisture are present in the atmosphere.

Sports venues, such as the New Hampshire Motor Speedway (NHMS) in Loudon, are also at enhanced risk for lighting hazards due to the topography of the land and venue infrastructure. In 2012, a man was killed at a NASCAR race in Pennsylvania when he was struck by lightning 5 minutes after the race was stopped[138]. NHMS has a site safety plan and there is an Incident Action Plan (IAP) developed for every race which includes lightning precautions and triggering event information for evacuating the grandstands.

[137] http://www.vaisala.com/VaisalaImages/Lightning/NLDN%20CG%20Flashes,2007-2016,2-mi%20Grid.png?_ga=2.157439866.1533493048.1493747733-161204051.1489671258

[138] https://www.si.com/racing/2016/07/14/ap-car-nascar-lightning-strike-lawsuit-1st-ld-writethru

Extent:

While weather forecasters can and do forecast the likelihood of intense lightening activity, it is impossible to forecast individual strikes as lightning is so widespread, frequent, and random during a storm. There is also still not a full scientific understanding of the cloud electrification processes. Lightning strikes can be measured against each other through electrical calculations of the voltage and amperage that was discharged (the higher the voltage and amperage, the stronger and more severe the individual strike is). For the purposes of emergency management, all lightning strikes are viewed as equally dangerous regardless of their amps or volts, as any lightning strike is strong enough to cause infrastructure damage, injury, or death.

Research shows that the severity of a storm is roughly correlated to lightning frequency; however, there is significant regional variability and no direct correlation has yet been found.[139] That said, there appears to be a general increase in the frequency of lightning as a thunderstorm becomes more intense (i.e. larger in area and vertical growth, more organized, hail producing, etc.). There is currently not a widely adopted scale for measuring lightning storms in the northeastern United States. Based on information from the National Weather Service that is used in fire weather forecasts, the severity of lightning storms can be measured using the Lightning Activity Level (LAL) which is based on cloud and storm development as well as number of lightning strikes in a 5 minute period.

Lightning Activity Level (LAL)	Description
1	No Thunderstorms
2	Isolated thunderstorms. Light rain will occasionally reach the ground. Lightning is very infrequent, 1 to 5 cloud to ground strikes in a five minute period.
3	Widely scattered thunderstorms. Light to moderate rain will reach the ground. Lightning is infrequent, 6 to 10 cloud to ground strikes in a 5 minute period.
4	Scattered thunderstorms. Moderate rain is commonly produced Lightning is frequent, 11 to 15 cloud to ground strikes in a 5 minute period.
5	Numerous thunderstorms. Rainfall is moderate to heavy. Lightning is frequent and intense, greater than 15 cloud to ground strikes in a 5 minute period.
6	Dry lightning (same as LAL 3 but without rain). This type of lightning has the potential for extreme fire activity and is normally highlighted in fire weather forecasts with a Red Flag Warning.

Impacts:

Lightning poses a large threat to humans when precautions are not taken. Most lightning injuries in humans are due to exposure during thunderstorms and failure to find adequate shelter. A lightning strike can kill humans and animals by disrupting the natural electricity of the central nervous system causing cardiac arrest. A person who is struck by lightning can survive, but often suffers from superficial burns, loss of consciousness, amnesia, confusion, tingling, and other medical issues. Basic lightning

[139] https://journals.ametsoc.org/doi/abs/10.1175/1520-0493%282003%29131%3C1211%3ATRBSSR%3E2.0.CO%3B2

safety precautions to avoid lightning strike include seeking safe shelter in an enclosed building, staying away from water and electrical sources within the building, and refraining from standing near windows to observe the storm. If caught outside with no study structure to take shelter in, a closed vehicle is the next best option, followed by crouching in a ditch on the balls of your feet to minimize contact with the ground. The most obvious solution is to check the weather forecast before outdoor activities and rescheduling if thunderstorms are forecast.

Lightning is also a major cause of wildfires and it may take days from the storm for an actual fire to become apparent. Additionally, lightning can damage communications and electrical systems by overloading the electronic components and wiring with much higher voltages and amperage than the equipment can handle.

Building and property damage can also result from lightning strikes. Building fires, explosions, power surges, power outages, thermal damage, electromagnetic forces, and sparking are all possible from a single lightning strike.

Previous Occurrences:
Lightning storms occur on an annual basis and frequently results in minor power outages/surges, strikes near and to buildings which can result in isolated fires, electrical damage, damage to powerlines and transformers, and has started several wildfires in the state.

Notable events

Event Date	Event Description	Impacts	Location	Additional Information
06/25/2012	Strike to Sarah Long Bridge	Lift mode function damaged, gauges knocked out. Bridge was closed for hours while repairs took place	Portsmouth	
07/04/2012	Residential Strike	3 people treated with non-life-threatening injuries from a nearby lightning strike	Laconia	
08/04/2012	Sports Venue Strike	$200,000 in damages to equipment and building	Goffstown	Goffstown Babe Ruth League
06/24/2013	Strike at Boy Scout Camp	Nearly thirty people were transported to the hospital after complaining of tingling and burning sensations following a nearby lightning strike	Belmont	Camp Bell Scout Reservation

Event Date	Event Description	Impacts	Location	Additional Information
09/01/2013	Campground Strike	Man and 14-year old boy were struck by lightning at a campground receiving minor injuries[140]	Tamworth	Possibly a positive charged lightning strike as it was ahead of the storm and very bright.
August 2016	Residential strike	$5,000.00 in damages, extinguished by 14-year old boy and grandfather.[141]	Manchester	

[140] http://www.wmur.com/article/manchester-man-survives-lightning-strike-in-new-hampshire/4632689
[141] http://www.unionleader.com/weather/For-Manchester-family-lightning-strike-was-a-close-call-08142016

Severe Winter Weather

HIRA Risk: High
Future Probability: High
Counties at Risk: All

Definition:
The State of New Hampshire experiences four types of severe weather during the winter months, which usually bring snow, high winds, and/or rain depending on temperatures:

Heavy Snow
In forecasts, the amount of snow that is expected to fall is expressed as a range of values, such as 10-12". There can be considerable uncertainty regarding snowfall values during heavy snowstorms and phrases such as "…up to 20 inches" or "….12 inches or more" can be utilized. Heavy snow is generally defined as[142]:

- Snowfall accumulating to 4" or more in depth in 12 hours or less; or
- Snowfall accumulating to 6" or more in depth in 24 hours or less.

Blizzard
A blizzard is a snowstorm with the following conditions that is expected to prevail for a period of 3 hours or longer[143]:

- Sustained wind or frequent gusts to 35mph or greater; AND,
- Considerable falling and/or blowing snow that frequently reduces visibility to less than ¼ mile

Nor'easter
A Nor'easter is a large cyclonic storm that tracks north/northeastward along the East Coast of North America. It is so named due to the northeasterly prevailing wind direction that occurs during the storm. While these storms may occur at any time of the year, they are most frequent and severe during the months of September through April. Nor'easters usually develop off the east coast between Georgia and New Jersey, travel northeastward, and intensify in the New England region. Nor'easters nearly always bring precipitation in the form of heavy rain and/or snow, as well as gale force winds, rough seas, and coastal flooding.[144]

New Hampshire (New England) is especially susceptible to strong Nor'easters during the winter as the polar jetstream transports cold, artic air southward across the northern central US. This airmass then moves eastward toward the Atlantic Ocean where it meets warm air from the Gulf of Mexico generating a strong low pressure system. The warm waters of the Gulf Stream help keep the coastal waters off of New England relatively mild during the winter, which in turn helps warm the cold winter air over the water. The presence of the relatively warmer, moist air over the Atlantic and cold, dry Arctic air over the land provide the temperature contrast necessary to generate the strong frontal boundaries that help a Nor'easter intensify.[88]

[142] http://forecast.weather.gov/glossary.php?word=HEAVY%20SNOW
[143] http://w1.weather.gov/glossary/index.php?letter=b
[144] http://www.nws.noaa.gov/om/winter/noreaster.shtml

Ice Storm

Ice storms typically occur with warm frontal boundaries, where warm air rises up and over a shallow mass of cold air near the earth's surface. When snow falls from clouds near just north of the warm frontal boundary, it will fall through the deep warm layer aloft first and melt completely into a liquid water droplet. As it passes through the shallow cold layer near the surface, the water droplet cools to the point of being supercooled (a liquid raindrop that remains a liquid at the freezing point). When these supercooled water droplets make contact with freezing surfaces on the ground, such as streets and walkways, they freeze on contact forming layers of ice. This process of freezing rain, when persistent over a long period of time, will form layers that may exceed over an inch thick in extreme cases.

Any accumulation of ice can present hazards; however, significant accumulations of ice (1/4" or greater) can pull down trees and utility lines resulting in loss of power and communications. Walking and driving also becomes very dangerous to almost impossible during an ice storm.[145]

Location:

The entire State of New Hampshire is at risk for severe winter storms. Higher elevations are at an increased risk for ice accumulation.

Background and evolving hazard information:

New Hampshire's natural climate allows for frozen precipitation to occur during the winter months, most commonly between December and March, when the average high temperature ranges between 36°F and 44°F and average monthly snowfall ranges between 11 and 18 inches. On average, New Hampshire receives a total annual snowfall of 61 inches.[146] Due to natural variations in climate and synoptic meteorology patterns, it is not impossible for areas of the State, especially higher elevations, to receive snow earlier or later in the year than the average. On May 26, 2013, the State experienced snowfall that tied the previous record for latest snowfall experienced in the State since 46 years prior on May 26, 1967. While most of the snowfall did not accumulate, there were small accumulations in the higher elevations[147].

Cars along Ocean Blvd in Hampton after the Blizzard of '78
(Source listed below)

Based on historical experience, the State of New Hampshire will receive some form of severe winter weather multiple times within a given year.

[145] http://w1.weather.gov/glossary/index.php?word=ice+storm
[146] http://www.usclimatedata.com/climate/new-hampshire/united-states/3199
[147] http://www.unionleader.com/apps/pbcs.dll/article?AID=/20130526/NEWS11/130529380
Photo Credit: http://www.hampton.lib.nh.us/hampton/history/storms/78weaker.htm

Nor'easters are a common occurrence in New Hampshire. That said, the State is well equipped to handle most snowstorms without outside resources. With the exception of extremely cold temperatures, mixed precipitation, ice, and strong winds, regular or heavy snowstorms do not cause disastrous impacts to the State. State and local plow trucks may take time to clear the roads, and schools and businesses may close for the day(s), but the impacts these events cause are often quickly resolved.

With that being said, any ice accretion or compounding factors of cold temperatures, strong winds, high moisture content snow, and/or back to back severe winter weather can cause major disruption, property and utility damage, injuries, and deaths in the State.

Extent:

Heavy Snow

The severity of a heavy snow storm is directly dependent on how much snow is falling and how fast it is falling. This is usually expressed by the National Weather Service in the amount of inches that an affected area of the State will receive and the amount of time that they are expected to receive that snowfall in. Also, the amount of snow that falls in an hour is a unit of measurement of severity for a heavy snow storm. Storms that produce 2 inches of snowfall in an hour or more begin to tax the ability of snowplows to keep the roadways clear, can produce blizzard like conditions when combined with wind, and can quickly lead to treacherous road conditions. The Winter Storm Warning criteria for the State of New Hampshire are as follows:

- 6" or more of snow expected in a 12 hour period –or
- 9" or more of snow is expected in a 24 hour period –or
- a combination of snow, ice, and/or wind that produces life threatening impacts is expected

NOAA has developed the Regional Snowfall Index (RSI) which is a snowfall impact scale that uses the area of snowfall, amount of snowfall, and population to attempt to quantify the societal impacts of a snowstorm.[148]

Category	RSI Value	Description	Approximate % of Storms
0	0-1	N/A	54%
1	1-3	Notable	25%
2	3-6	Significant	13%
3	6-10	Major	5%
4	10-18	Crippling	2%
5	18+	Extreme	1%

The RSI is an evolution of the previous Northeast Snowfall Impact Scale (NESIS).

Blizzard

As a blizzard has specific scientific conditions that are either met or not met for a storm, the RSI scale referenced above could assist in the severity rating of a blizzard.

[148] https://www.ncdc.noaa.gov/snow-and-ice/rsi/overview

Nor'easter

The severity of a Nor'easter is directly dependent on the time of year and the type of weather that the Nor'easter brings. Nor'easters during the winter can cause heavy snowfall, blizzard conditions, ice, and strong winds. Occasionally these strong coastal low pressure systems will occur during the summer and can produce significant rainfall, cause flooding, and generate tornadoes or straight-line wind events (micro/macrobursts). The severity of Nor'easters along coastal areas can also be measured by using storm tide and storm surge amounts as described in the coastal flooding section.

Ice Storm

The Ice Storm Warning criteria for The State of New Hampshire is an accumulation of ½" of ice or greater. Although there is currently not a widely adopted scale for measuring ice storms, based on information from the US Forest Service following the 1998 Ice Storm, the severity of ice storms can be viewed in terms of the amount of ice accumulation, the duration of that accumulation, and the resulting damage. The number of variables that need to be taken into consideration to accurately measure the intensity of an ice storm make the process difficult. Some resources, such as weather stations, are not able to measure ice accumulations; therefore, observers must report accumulations to the weather service to get an accurate depiction of the severity of an icing event. Furthermore, ice accumulation can vary drastically over topography and over short distances, making interpolation of reported values less accurate.[149]

In 2008, Sid Sperry (official with the Oklahoma Association of Electric Cooperatives) and Steve Piltz (meteorologist in charge of the Tulsa NWS office) worked to develop a scale and method for measuring the severity of an ice storm. The Sperry-Piltz Ice Accretion Index (SPIA Index) was developed to take into consideration ice thickness, wind speed and direction, and temperatures for the storm period to develop a severity index score across five levels.[150]

Although not widely adopted, National Weather Service offices across the country that receive ice are testing this scale for its viability at being the next Saffir-Simpson style scale for measuring ice storms.

[149] https://www.fs.fed.us/rm/pubs/rmrs_gtr292/2000_irland.pdf
[150] http://abc7amarillo.com/weather/study-designed-to-measure-ice-storm-severity

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" – Copyright, February, 2009

ICE DAMAGE INDEX	* AVERAGE NWS ICE AMOUNT (in inches) *Revised-October, 2011	WIND (mph)	DAMAGE AND IMPACT DESCRIPTIONS
0	< 0.25	< 15	Minimal risk of damage to exposed utility systems; no alerts or advisories needed for crews, few outages.
1	0.10 – 0.25	15 - 25	Some isolated or localized utility interruptions are possible, typically lasting only a few hours. Roads and bridges may become slick and hazardous.
	0.25 – 0.50	> 15	
2	0.10 – 0.25	25 - 35	Scattered utility interruptions expected, typically lasting 12 to 24 hours. Roads and travel conditions may be extremely hazardous due to ice accumulation.
	0.25 – 0.50	15 - 25	
	0.50 – 0.75	< 15	
3	0.10 – 0.25	> = 35	Numerous utility interruptions with some damage to main feeder lines and equipment expected. Tree limb damage is excessive. Outages lasting 1 – 5 days.
	0.25 – 0.50	25 - 35	
	0.50 – 0.75	15 - 25	
	0.75 – 1.00	< 15	
4	0.25 – 0.50	> = 35	Prolonged & widespread utility interruptions with extensive damage to main distribution feeder lines & some high voltage transmission lines/structures. Outages lasting 5 – 10 days.
	0.50 – 0.75	25 - 35	
	0.75 – 1.00	15 - 25	
	1.00 – 1.50	< 15	
5	0.50 – 0.75	> = 35	Catastrophic damage to entire exposed utility systems, including both distribution and transmission networks. Outages could last several weeks in some areas. Shelters needed.
	0.75 – 1.00	> = 25	
	1.00 – 1.50	> = 15	
	> 1.50	Any	

(Categories of damage are based upon combinations of precipitation totals, temperatures and wind speeds/directions.)

The Sperry-Piltz Ice Accumulation Index, or "SPIA Index" *(Source: Sperry and Piltz, 2009)*

Impacts:

All severe winter storms present a hazard to life, property, and the environment. Although winter is an annual, expected, occurrence in the State of New Hampshire, the cold temperatures, precipitation, wind, and slippery conditions result in numerous injuries and deaths each year due to exposure and traffic accidents. Even in the absence of *severe* winter weather, the winter season presents a threat for extreme cold temperatures, placing people and animals at risk for hypothermia and frostbite resulting in temporary to permanent injuries or death.

Seasonal build-up of snow and ice can cause damage to property and the environment by collapsing buildings, destroying utility infrastructure/lines, and damaging trees and vegetation. Property owners should always be aware of snow load on structures throughout the winter and should be regularly clearing roofs and outbuildings. While a single large storm may cause a structural collapse, the threat of a structural collapse increases throughout the winter season, especially if there are frequent snowstorms with high total accumulations.

There are also secondary impacts that occur because of severe winter weather. The first is carbon monoxide poisoning. Numerous people are injured and killed annually through the improper use and/or venting of generators or heating equipment. Structure fires are also a result of improper use and venting of generators, heating equipment, and improper cleaning of chimneys/vents.

Heavy Snow Storm

A heavy snow storm can bring a significant amount of snowfall to the affected area(s), which can result in treacherous and impassability of roadways, damage to infrastructure and buildings due to snow load (exacerbated when the snow has a high moisture content increasing the density of the snow), power

outages and long-term utility outages, closed businesses and economics, as well as the impacts listed above.

Blizzard

Blizzard conditions present an immediate danger to people and pets that are outside due to the bitterness of the wind and lack of visibility. Frostbite and hypothermia can occur very quickly to exposed skin in blizzard conditions. Anyone who is out walking or driving (vehicles, snowmobiles, etc.) can be injured or killed due to the lack of visibility – whiteout conditions can come suddenly and without warning.

Nor'easter

Nor'easters have the potential to impact the State to a higher degree than hurricanes and tornadoes as they occur more frequently. These storm systems also have a much larger diameter than a hurricane and therefore affect a much larger geographical area. The impacts of a Nor'easter include: storm tides and surges that lead to beach erosion along the coast; heavy precipitation (rain, snow, sleet, freezing rain, and a mixture) that cause inland flooding and/or ice jams; riverine erosion; damage to roads and drainage infrastructure; heavy winds which can damage buildings, utility infrastructure, and trees; ice; and secondary hazards which result from structure fires and carbon monoxide poisoning.

Ice Storms

Ice storms are incredibly dangerous and can cause severe impacts and millions of dollars in damages. Ice can increase the weight of branches by 30 times and a ½" of ice coverage on powerlines can add 500lbs of extra weight. The 1998 Ice Storm caused more than $1.4 Billion in damages to Northern New York and New England. Travel can become extremely dangerous with any amount of ice accumulation. When there is ¼ to ½" of ice accumulation, damage to trees and powerlines causes utility outages and road closures. Additionally, dangerous road conditions and other impacts, as described above, may occur. Any ice accumulation greater than ½" can be catastrophic, resulting in much more severe tree and utility infrastructure damage that will require extensive recovery efforts and lead to widespread power outages that may last days or weeks.[151]

Costs associated with clearing State roads are projected and incorporated into yearly budgets, limiting the economic impact on fiscal budgets, with the exception of above average snowfall years. The table below shows NH DOT – Highway Maintenance and Turnpike statistics from State fiscal years 2014-2018, each running from July 1st through June 30th, which highlights the costs and staffing hours associated with snow and ice removal from State roads.

Fiscal Year	Dollars Spent	Hours Plowing	Lane Miles Plowed
2014	$54,942,542	313,175	2,753,141
2015	$56,992,397	337,649	2,911,386
2016	$37,675,292	175,998	1,517,337
2017	$58,508,235	339,653	2,861,939
2018*	$56,487,856	299,765	2,551,589

* Year to Date

[151] https://weather.com/news/news/ice-storm-damage-impacts-20121123

Previous Occurrences:

Severe winter weather occurs on an annual basis and frequently results in traffic disruptions, traffic accidents, fires, and short-term power outages. On a localized scale, people are injured and killed due to primary and secondary effects of severe winter weather annually.

While these events occur with high frequency, by and large a significant coordinated response is not required, the State's emergency response capabilities as a whole are not taxed. Preparations and monitoring occur for each and every potential storm and some coordination is done, such as conference calls between the national weather service, HSEM, state department heads, local communities, and schools; however, this is mostly a preparedness and response function.

For the purposes of this plan, as severe winter weather is completely unavoidable in New Hampshire, events summarized below are those events which caused significant damages, had long duration impacts, resulted in numerous injuries and deaths, required a major coordinated effort, and/or presented a unique set of hazards or challenges. This will allow for an understanding of the major potential impacts that the state is susceptible to in larger events and can be used to determine potential mitigation actions to limit these impacts.

Notable Previous Occurrences:

Event Date	Event Description	Impacts	Location	Additional Information
12/17-20/1929	Ice Storm	Unprecedented disruption and damage to telephone, telegraph, and power system	Statewide	
02/14-17/1958	Heavy Snow	10-20" of snowfall across New England	Statewide	
12/12/1960	Heavy Snow and Wind	13-17" of snow and winds between 36-51 MPH across New England	Statewide	
01/19-20/1961	Heavy Snow	24" of snowfall	Statewide	
02/03-04/1961	Heavy Snow and Wind	8-40" of snow and hurricane gale force winds across New England	Statewide	
01/27-31/1966	Severe Winter Storm	Large amount of snowfall resulting in disruption of power and transportation	Statewide	
02/06-07/1978	Blizzard of '78	Major Nor'easter brought nearly two feet of snow which was exacerbated by the hurricane force winds creating very large snow drifts. Roadways were shut down, people were truly "snowed-in". Major coastal erosion. Hampton was one of the hardest hit areas – low tide during this event was higher than the normal high tide, sand and debris was strewn everywhere as well as large boulders brought onshore and 5' deep piles of gravel. Many buildings were damaged or destroyed. Houses were in the middle of the road and in North Hampton fishing shacks were on Ocean Blvd.[152] Dozens of people died from the storm from cold exposure, heart attacks from shoveling, asphyxiation, carbon monoxide poisoning, and drowning in state.	Statewide	One of the worst and most significant blizzards in New England's History – 17-40" of snow fell, 99 people died, 4,500 people injured, $520 Million in Damages, 3,000 cars and 500 trucks abandoned on an 8 mile stretch of Route 128.[153]

[152] http://www.hampton.lib.nh.us/hampton/history/storms/78weaker.htm
[153] http://www.blizzardof78.org/

Event Date	Event Description	Impacts	Location	Additional Information
01/08-25/1979	Ice Storm	Major Disruption to power and transportation	Statewide	
02/14-15/1986	Ice Storm	Fierce Ice Storm in higher elevations in the Monadnock Region. 10 Miles wide of Ice from Massachusetts border to New London, New Hampshire	Western New Hampshire	
03/03-06/1991	Ice Storm	Major power outages from Ice Storm	Southern New Hampshire	
03/16/1993	Heavy Snow	EM-3101 nearly over $800,000 in damages and numerous power outages	Statewide	
01/07-16/1998	Major Ice Storm	17 Million Acres of forestland in New England damaged[154] and major damage to utility infrastructure	Statewide	
03/05-07/2001	Heavy Snow	$4.5 Million in Damages, numerous power outages, DR-3166	Statewide	
02/17-18/2003	Heavy Snow	$3 Million in Damages, numerous power outages and received Emergency Declaration EM-3177	Statewide	
01/15/2004	Heavy Snow	$3.2 Million in Damages, numerous power outages, received Emergency Declaration EM-3193	Statewide	
03/30/2005	Heavy Snow	$4.6 Million in Damages, numerous power outages, received Emergency Declaration EM-3207	Statewide	
04/28/2005	Heavy Snow	$4.6 Million in Damages, numerous power outages, received Emergency Declaration EM-3207	Statewide	
12/11-23/2008	Ice Storm	Schools closed, state of emergency, Hospitals on diversion, local EOCs open, numerous shelters opened and received over 1,000 people, 400,000 customers without power (representing more than half of the population of the state). Over 300 roads (state and local) completely closed. 2,122 calls in first few days National Guard deployed nearly 100 troops, door-to-door canvassing of at-risk individuals, transportation stopped, sawyer crews deployed to clear critical communications points, nearly 150 people injured from CO and 2 people killed from CO. Estimated that this storm is one of the costliest and deadliest storms in the State's history. Estimated nearly $20 Million in damages. EM-3297 and DR-1812	Statewide	211 of 234 communities were affected by the storm. The Northern part of the state was least affected while south and southwestern New Hampshire was most impacted
02/23-03/03/2010	Severe Winter Storm	Extreme winds caused significant amount of power outages, massive amount of debris, and nearly $20 Million in Damages. DR-1892	Statewide	

[154] http://emergencypreparedness.cce.cornell.edu/disasters/Documents/PDFs/ice%20and%20silviculture.pdf

Event Date	Event Description	Impacts	Location	Additional Information
10/29-30/2011	"Snowtober" Nor'easter	A significant early snowstorm dropping heavy wet snow struck New Hampshire when a lot of the leaves were still on the trees causing a large amount of damage to trees and power infrastructure. Nearly $4.5 Million in Damages. DR-4049	Statewide	Thundersnow was experienced in the southern part of the state
02/08-10/2013	Blizzard "Nemo"	The state received over two feet of snow in many areas of central and southern New Hampshire. Travel was hampered while plow trucks cleared roadways; however, most drivers stayed off roadways. Incident delivered a significant amount of snow in a short period of time, but only limited power outages and damages were reported. Received Disaster Declaration related to debris removal. DR-4105	Statewide	
01/02-03/2014	Heavy Snow	The storm brought 6 to 14 inches of snow across the much of the state south of Coos County.	Statewide	
2/5/2014	Heavy Snow	Six to twelve inches of snow fell across eastern Hillsborough County. Eight to thirteen inches of snow fell across western and central Hillsborough County. Six to 9 inches of snow fell across Cheshire County.	Statewide	Low pressure moving off the mid-Atlantic coast intensified as it moved northeastward over Nantucket. This spread heavy snow across all of southern New England.
01/26-29/2015	Heavy Snow	Snowfall amounts ranged from 10 to more than 30 inches across much of the southeastern part of the state. Elsewhere, amounts were generally 6 to 14 inches with some lower amounts in the Connecticut River Valley. This storm resulted in DR-4209.	Statewide	An area of low pressure developed off the Delmarva peninsula on Monday, January 26th, and intensified rapidly as it moved slowly northward through the 27th. Snow spread northward across the region Monday night and became heavy on Tuesday, the 27th. Winds became strong during the day Tuesday leading to blizzard conditions at times along and inland from the coast. The snow persisted into Tuesday night in many areas with blowing and drifting snow. Along the coast, large waves combined with a storm surge produced coastal flooding and splash over. In Hampton, the Tuesday morning tide was 1.43 feet above flood levels, inundating many streets on the bay side of town.

Event Date	Event Description	Impacts	Location	Additional Information
2/14/2015	Heavy Snow	Snowfall amounts ranged from 6 to 12 inches across much of the area with up to 17 inches along the coast.	Statewide	Low pressure dropping southeast from Canada on the morning of the 14th intensified rapidly as it developed into two separate areas of low pressure southeast of Cape Cod. The two lows brought a moderate to heavy snow across the southern half of the state and near blizzard conditions along the coast.
12/29/2016	Heavy Snow	Much of New Hampshire received between 6 and 16 inches of snow with lesser amounts along the Connecticut River Valley. Along the Seacoast, most of the precipitation fell as rain with only an inch or two of snowfall accumulation. Inland from the coast and across southern areas, the rain changed to a heavy, wet snow which clung to trees and wires which resulted in scattered power outages. More than 11,000 homes and businesses saw outages due to the storm.	Statewide	An area of low pressure moving northeast from the Carolinas on the morning of the 29th combined with a low dropping southeast from Canada to form an intense area of low pressure that moved through the Gulf of Maine during the early morning hours of the 30th.
2/9/2017	Heavy Snow	Snowfall amounts generally ranged from several inches in Coos County to more than 15 inches in interior Rockingham County.	Statewide	An area of low pressure off the Delmarva Peninsula on the morning of the 9th intensified rapidly as it moved northeast through the Gulf of Maine during the day. The low brought heavy snow to all but Grafton and Coos Counties.
3/14/2017	Heavy Snow	High winds and/or heavy wet snow downed trees and created numerous power outages across southeastern portions of the State. Snowfall amounts across New Hampshire ranged from about 12 to 20 inches. In the Seacoast area, the strong winds combined with heavy wet snow to cause numerous power outages. Farther inland, across Belknap and Carrol Counties, the strong winds downed trees onto roads and wires leading to blocked roads and power outages. Particularly hard hit was a section of Route 109 in the Town of Tuftonboro where downed trees snapped utility poles and brought down wires. This storm resulted in DR-4316.	Statewide	The storm brought heavy snow to all of New Hampshire with high winds leading to blizzard or near blizzard conditions across much of central and southern portions of the State. Much of the snow in any given area fell during about a six-hour window with weather spotters reporting snowfall rates of 2 to 3 inches per hour. Some of the stronger wind gusts across New Hampshire included 82 mph at the Isle of Shoals, 62 mph in Portsmouth, 45 mph in Laconia, 41 mph in Concord, 40 mph in Manchester, 38 mph in Whitefield and Rochester, and 37 mph in Keene.

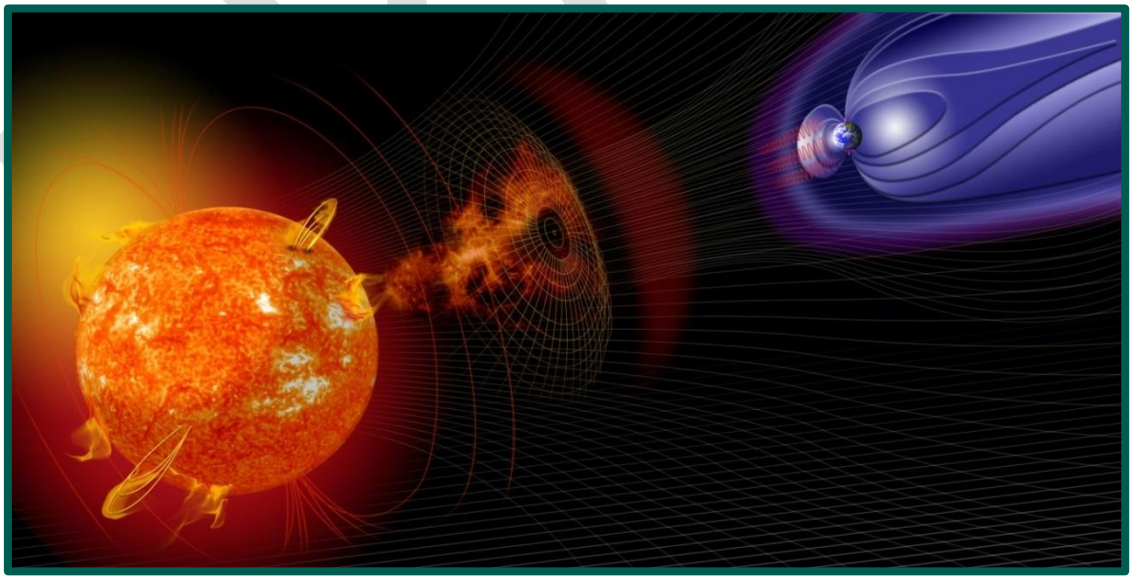
Event Date	Event Description	Impacts	Location	Additional Information
1/4/2018	Heavy Snow	The storm brought 10 to 15 inches of snow to much of New Hampshire, with lesser amounts along the Connecticut River Valley.	Statewide	The energy from a storm slipping southeast from the Great Lakes merged with the energy from low pressure off the southeast U.S. coast to form an intense area of low pressure off the mid-Atlantic coast by the morning of January 4th. The intense low brought heavy snow and high winds to much of the region, with blizzard conditions to the Seacoast area. In addition, the storm brought coastal flooding and erosion along the coast.
3/1-9/2018	Snow and Coastal Flooding	Back to back coastal storms produced high winds, a large storm surge, and large battering waves along the New Hampshire coast. This storm resulted in DR-4370.	Statewide	Particularly hard hit were coastal communities along the seacoasts of New Hampshire and southwestern Maine where the large battering waves damaged roads and infrastructure along the coast. Although tide levels were below flood levels for some of this period, the large waves continued to produce damage at the times of high tide.
3/13/2018	Heavy Snow	Snowfall totals ranged from about 15 to 29 inches across the State. In addition, blizzard to near blizzard conditions were reported in coastal Rockingham County from mid-morning through mid-afternoon. This storm resulted in DR-4371	Statewide	The storm brought heavy snow to all of New Hampshire with the greatest amounts across the southeastern part of the State.

Solar Storms and Space Weather
HIRA Risk: Low
Future Probability: Low
Counties at Risk: All

Definition:
The term space weather is relatively new and describes the dynamic conditions in the Earth's outer space environment, similar to how the terms "climate" and "weather" refer to the conditions in the Earth's lower atmosphere. Space weather includes any and all conditions and events on the sun, in the solar wind, in near-Earth space, and in our upper atmosphere that can affect space-borne and ground-based technological systems.[155]

Solar activity (solar storms) refers to solar flares, coronal mass ejections, high-speed solar wind, and energetic solar particles. Any these events may occur for a few minutes to several hours, have the ability to affect Earth for days to weeks. All solar activity is driven by the solar magnetic field. A solar flare is an intense burst of radiation resulting from the release of sunspot magnetic energy, which can occur for minutes to hours. Solar prominence is a large, bright feature that extends outward from the sun's surfaces. A coronal mass ejection (CME) occurs when the outer solar atmosphere's magnetic field is closed, resulting in a confined atmosphere that suddenly explodes, releasing bubbles of gas and magnetic fields. The surface of the sun is hot electrified gas boiling up from the interior of the sun out into space- this is referred to as high speed solar wind. Solar wind travels at 800,000 to 5 million miles per hour and carries mass the size of Utah's Great Salt Lake into space every second; however, solar wind is 1000 million times weaker than the winds that we experience on Earth[156]

A geomagnetic storm occurs when a CME or high-speed solar winds strike and begin to penetrate the Earth's magnetosphere and can decrease the Earth's magnetic field strength for 6-12 hours.



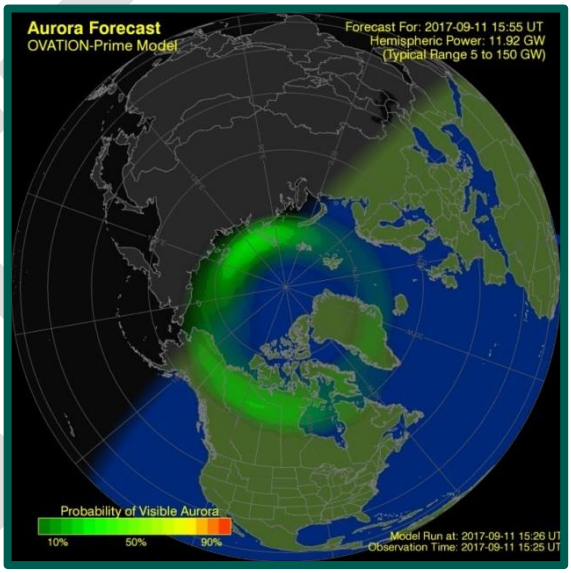
NASA Artist Depiction of sun events affecting Earth *(Source: NASA)*

[155] https://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html#q12
[156] https://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html

Location:
The entire State of New Hampshire is at risk for solar storms and space weather.

Background and evolving hazard information:
Space weather affects Earth due to the sun sending energy across the Earth in the form of light and electrically charged particles and magnetic fields. As the sun is a giant mass of energy constantly fusing atoms, it creates million degree temperatures and strong magnetic fields. Although space weather has occurred since the beginning of time, little was understood about the causes and impacts of these instances on the planet. It has only been in the last 200 or so years where multiple science fields have come together to study space weather.[157]

Not all space weather is damaging or effects humans or technology. Perhaps one of the most well-known effects of space weather on the Earth's atmosphere is the Aurora Borealis (aka Northern Lights – northern hemisphere) and the Aurora Australis (southern hemisphere). Aurora displays are a result of solar wind where some of the charged particles become trapped in the Earth's atmosphere.[102]



Aurora forecast image
(Source: The Aurora Service)

As society becomes increasingly reliant on electronics and technology, the hazards presented by space weather are not to be underestimated. The magnetic disturbances that solar storms can bring can disrupt communications, damage or destroy electronic components, corrode gas and oil pipelines, and cause significant damage to spacecraft and satellites outside the Earth's protective atmosphere.[102]

Radio operators have long been aware of the effects of space weather and how it impacts radio communications, especially those in the High Frequency (HF) band (3-30MHz). Depending on atmospheric conditions from space weather, radio signals can be partially or completely blocked, or may "skip" across the atmosphere and travel long distances beyond what is normally possible.

Most airliners communicate with line of sight radio frequencies that operate in the Very High Frequency (VHF) band (30-300MHz), and are transferred from control center to control center throughout a flight as part of the air traffic system. HF radios are used for transoceanic flights and flights to the poles as VHF radios cannot maintain a line of sight with the curvature of the Earth. HF waves can bend with the curvature of the Earth by bouncing off the atmosphere. For this reason, HF waves are most susceptible to electromagnetic interference which causes communications problems.

[157] https://www.nasa.gov/mission_pages/sunearth/spaceweather/index.html#q12

Extent:

Geomagnetic Storms

Scale	Description	Effect	Physical Measure	Average Frequency (1 cycle = 11 years)
G 5	Extreme	**Power systems:** Widespread voltage control problems and protective system problems can occur, some grid systems may experience complete collapse or blackouts. Transformers may experience damage. **Spacecraft operations:** May experience extensive surface charging, problems with orientation, uplink/downlink and tracking satellites. **Other systems:** Pipeline currents can reach hundreds of amps, HF (high frequency) radio propagation may be impossible in many areas for one to two days, satellite navigation may be degraded for days, low-frequency radio navigation can be out for hours, and aurora has been seen as low as Florida and southern Texas (typically 40° geomagnetic lat.).	Kp = 9	4 per cycle (4 days per cycle)
G 4	Severe	**Power systems:** Possible widespread voltage control problems and some protective systems will mistakenly trip out key assets from the grid. **Spacecraft operations:** May experience surface charging and tracking problems, corrections may be needed for orientation problems. **Other systems:** Induced pipeline currents affect preventive measures, HF radio propagation sporadic, satellite navigation degraded for hours, low-frequency radio navigation disrupted, and aurora has been seen as low as Alabama and northern California (typically 45° geomagnetic lat.).	Kp = 8, including a 9-	100 per cycle (60 days per cycle)
G 3	Strong	**Power systems:** Voltage corrections may be required, false alarms triggered on some protection devices. **Spacecraft operations:** Surface charging may occur on satellite components, drag may increase on low-Earth-orbit satellites, and corrections may be needed for orientation problems. **Other systems:** Intermittent satellite navigation and low-frequency radio navigation problems may occur, HF radio may be intermittent, and aurora has been seen as low as Illinois and Oregon (typically 50° geomagnetic lat.).	Kp = 7	200 per cycle (130 days per cycle)
G 2	Moderate	**Power systems:** High-latitude power systems may experience voltage alarms, long-duration storms may cause transformer damage. **Spacecraft operations:** Corrective actions to orientation may be required by ground control; possible changes in drag affect orbit predictions. **Other systems:** HF radio propagation can fade at higher latitudes, and aurora has been seen as low as New York and Idaho (typically 55° geomagnetic lat.).	Kp = 6	600 per cycle (360 days per cycle)
G 1	Minor	**Power systems:** Weak power grid fluctuations can occur. **Spacecraft operations:** Minor impact on satellite operations possible. **Other systems:** Migratory animals are affected at this and higher levels; aurora is commonly visible at high latitudes (northern Michigan and Maine).	Kp = 5	1700 per cycle (900 days per cycle)

Solar Radiation Storms

Scale	Description	Effect	Physical measure (Flux level of >= 10 MeV particles)	Average Frequency (1 cycle = 11 years)
S 5	Extreme	**Biological:** Unavoidable high radiation hazard to astronauts on EVA (extra-vehicular activity); passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Satellites may be rendered useless, memory impacts can cause loss of control, may cause serious noise in image data, star-trackers may be unable to locate sources; permanent damage to solar panels possible. **Other systems:** Complete blackout of HF (high frequency) communications possible through the polar regions, and position errors make navigation operations extremely difficult.	10^5	Fewer than 1 per cycle
S 4	Severe	**Biological:** Unavoidable radiation hazard to astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** May experience memory device problems and noise on imaging systems; star-tracker problems may cause orientation problems, and solar panel efficiency can be degraded. **Other systems:** Blackout of HF radio communications through the polar regions and increased navigation errors over several days are likely.	10^4	3 per cycle
S 3	Strong	**Biological:** Radiation hazard avoidance recommended for astronauts on EVA; passengers and crew in high-flying aircraft at high latitudes may be exposed to radiation risk. **Satellite operations:** Single-event upsets, noise in imaging systems, and slight reduction of efficiency in solar panel are likely. **Other systems:** Degraded HF radio propagation through the polar regions and navigation position errors likely.	10^3	10 per cycle
S 2	Moderate	**Biological:** Passengers and crew in high-flying aircraft at high latitudes may be exposed to elevated radiation risk. **Satellite operations:** Infrequent single-event upsets possible. **Other systems:** Small effects on HF propagation through the polar regions and navigation at polar cap locations possibly affected.	10^2	25 per cycle
S 1	Minor	Biological: None. Satellite operations: None. **Other systems:** Minor impacts on HF radio in the polar regions.	10	50 per cycle

Radio Blackout

Scale	Description	Effect	Physical measure	Average Frequency (1 cycle = 11 years)
R 5	Extreme	**HF Radio:** Complete HF (high frequency) radio blackout on the entire sunlit side of the Earth lasting for a number of hours. This results in no HF radio contact with mariners and en route aviators in this sector. **Navigation:** Low-frequency navigation signals used by maritime and general aviation systems experience outages on the sunlit side of the Earth for many hours, causing loss in positioning. Increased satellite navigation errors in positioning for several hours on the sunlit side of Earth, which may spread into the night side.	X20 (2×10^{-3})	Less than 1 per cycle
R 4	Severe	**HF Radio:** HF radio communication blackout on most of the sunlit side of Earth for one to two hours. HF radio contact lost during this time. **Navigation:** Outages of low-frequency navigation signals cause increased error in positioning for one to two hours. Minor disruptions of satellite navigation possible on the sunlit side of Earth.	X10 (10^{-3})	8 per cycle (8 days per cycle)
R 3	Strong	**HF Radio:** Wide area blackout of HF radio communication, loss of radio contact for about an hour on sunlit side of Earth. **Navigation:** Low-frequency navigation signals degraded for about an hour.	X1 (10^{-4})	175 per cycle (140 days per cycle)
R 2	Moderate	**HF Radio:** Limited blackout of HF radio communication on sunlit side, loss of radio contact for tens of minutes. **Navigation:** Degradation of low-frequency navigation signals for tens of minutes.	M5 (5×10^{-5})	350 per cycle (300 days per cycle)
R 1	Minor	**HF Radio:** Weak or minor degradation of HF radio communication on sunlit side, occasional loss of radio contact. **Navigation:** Low-frequency navigation signals degraded for brief intervals.	M1 (10^{-5})	2000 per cycle (950 days per cycle)

Impacts:

Solar storms and space weather are always impacting the Earth and its atmosphere, and are therefore an ongoing threat to New Hampshire. While the Earth is somewhat protected from solar storms and space weather by its upper atmosphere[158], the potential for a loss of communications, power, and GPS exists on a daily basis. New Hampshire is still at risk for a significant event that could affect utilities infrastructure, leading to a long term utilities outage. Individual components of the overall utilities infrastructure are inherently connected and becoming more sophisticated over time. This enhances the possible impacts of a severe space weather event and could increase the vulnerability of all sectors of critical infrastructure.

[158] https://www.nasa.gov/content/goddard/themis-discovers-new-process-that-protects-earth-from-space-weather

Previous Occurrences:

While no significant, damaging solar storms or space weather have impacted in the State of New Hampshire in recent years, HF radio communications routinely experience minor impacts or disruptions. Occasionally, when there is a particular large CME, the aurora borealis is visible in areas of New Hampshire. Nearby events include Quebec, Canada, which experienced a 9-hour blackout in March of 1989 when solar winds caused a fluctuation in the Earth's magnetic field and caused Hydro-Quebec's transmission to go down. Quebec is 150 miles north of Pittsburg, New Hampshire.

Tropical and Post-Tropical Cyclones

HIRA Risk: Medium
Future Probability: Medium
Counties at Risk: All

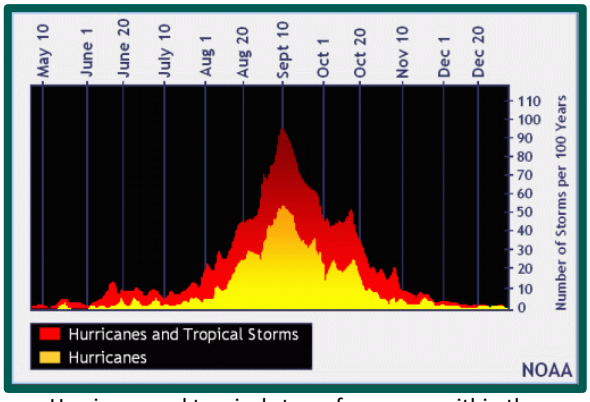
Definition:

A tropical cyclone is the generic term for a non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized convection (i.e. thunderstorm activity) and defined cyclonic surface wind circulation. Once formed, a tropical cyclone is maintained by the extraction of heat energy from the ocean at high temperature and heat export at the low temperatures of the upper troposphere.[159] There are several stages throughout the life cycle of a tropical cyclone[160]:

- **Potential Tropical Cyclone:** Term used by the National Hurricane Center (NHC) in advisory products to describe a disturbance that is not yet a tropical cyclone, but which poses the threat of bringing tropical storm or hurricane conditions to land areas within 48 hours. This is a new term that was introduced by the NHC in the summer of 2017.[161]
- **Tropical Disturbance:** A tropical disturbance is a cluster of showers and thunderstorms that flares up over the tropics. It is typically about 100 to 300 miles in diameter and generally moves westward. Tropical disturbances last for more than 24 hours, so there's a clear distinction between diurnal convection and tropical disturbances. Lacking a closed circulation of winds, tropical disturbances do not qualify as tropical cyclones.
- **Tropical Storm:** Once the maximum sustained winds of a developing tropical cyclone reach 34 knots (39 MPH), the low-pressure system is typically called a tropical storm and is assigned a formal name. The tropical cyclone maintains a tropical-storm status as long as its maximum sustained winds are above 34 knots and less than 64 knots (74 MPH).
- **Hurricane:** Once a tropical cyclone's maximum sustained winds reach 64 knots (74 MPH), the storm becomes a hurricane (in the North Atlantic and Northeast Pacific Ocean basins).
- **Major Hurricane:** A tropical cyclone with maximum stained winds of 96 knots (111 MPH) or higher.
- **Post-tropical Cyclone:** A former tropical cyclone, this term is used to describe a cyclone that no longer possess the sufficient tropical characteristics to be considered a tropical cyclone. These post-tropical cyclones often undergo an extratropical transition and form frontal boundaries. Post-tropical cyclones can continue carrying heavy rains and high winds and cause storm surge.

Location:

The entire State of New Hampshire is at risk for tropical cyclones. This hazard is very seasonally dependent: the Atlantic hurricane season officially runs from June 1st to November 30th each year. These dates were selected as they encompass over 97% of tropical activity; however, hurricanes have occurred outside of the official season



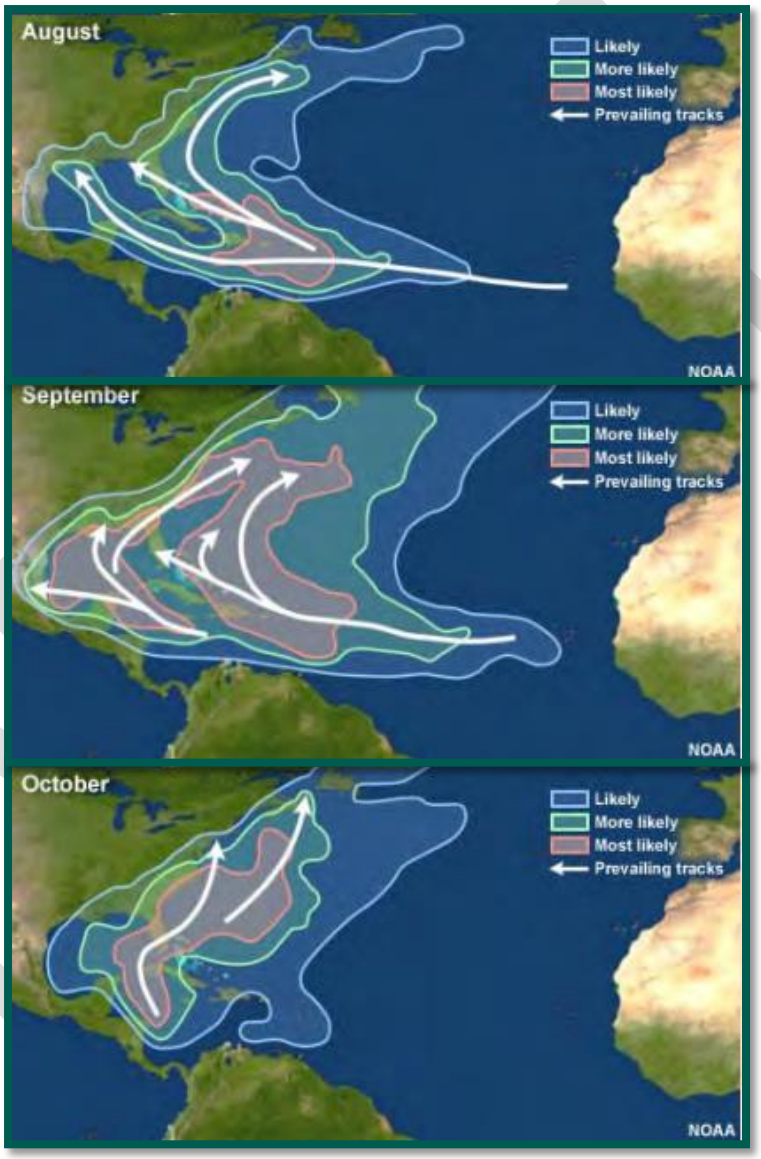
Hurricane and tropical storm frequency within the Atlantic hurricane season *(Source: NOAA)*

[159] http://www.nhc.noaa.gov/aboutgloss.shtml
[160] https://courseware.e-education.psu.edu/courses/meteo241/Images/Section1/tropical_cyclones0103.html
[161] https://www.nhc.noaa.gov/news/20170309_pa_2017SeasonChanges.pdf

dates[162][163]. The peak of the Atlantic hurricane season falls in mid-September, followed by a lesser secondary peak in activity in mid-October.

Background and evolving hazard information:

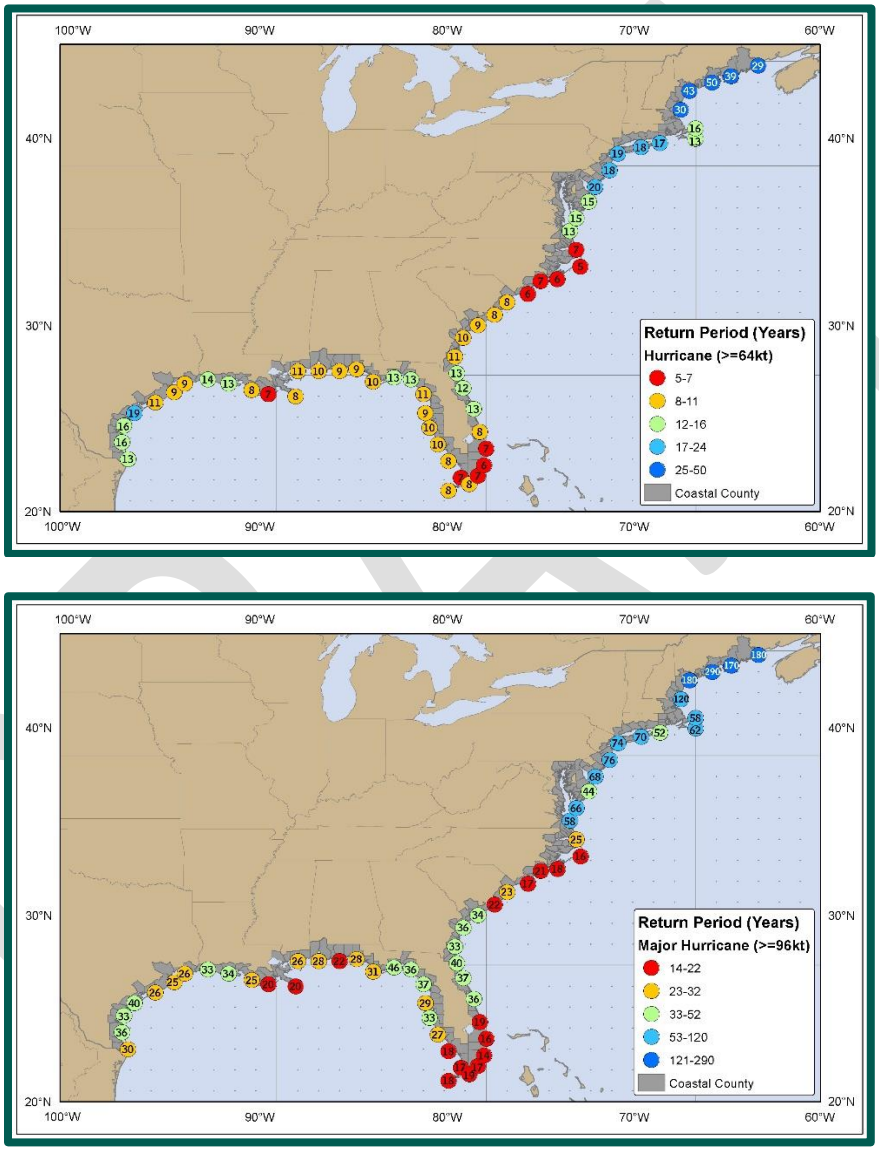
New Hampshire has been identified as a potential affected area for Hurricanes through the NWS National Hurricane Center's (NHC's) Risk Analysis Program (HURISK). Based on this information, the most likely time for New Hampshire to be impacted by a Hurricane is during the months of August through October[164].



Most likely paths of Atlantic tropical cyclones
(Source: NOAA)

[162] http://www.aoml.noaa.gov/hrd/tcfaq/G1.html
[163] http://www.nhc.noaa.gov/climo/
[164] http://www.nhc.noaa.gov/climo/

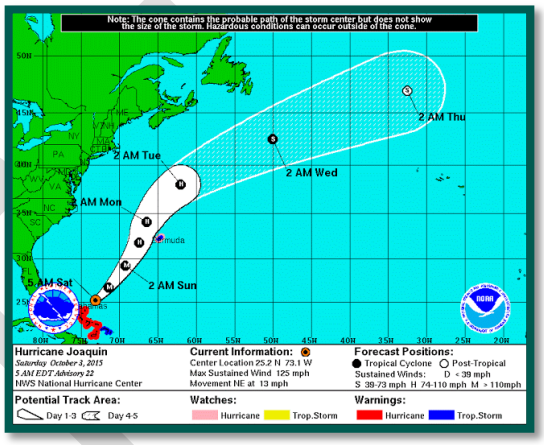
The hurricane return period is the frequency at which a certain intensity of hurricane can be expected within a given distance from a given location. In simpler terms, a return period of 20 years for a major hurricane means that *on average* during the previous 100 years, a Category 3 or greater hurricane passed within 50nm (58 statute miles) of that location about 5 times. It is then expected that, on average, an additional five Category 3 or greater hurricanes would occur within that 50nm radius over the next 100 years. Through the HURISK program, it was determined that New Hampshire has a return period of 30 years for a hurricane and 120 years for a major hurricane[165].



Return period, in years, for Atlantic hurricanes (top) and major hurricanes—category 3 or higher (bottom)
(Source: NOAA)

[165] http://www.nhc.noaa.gov/climo/

New Hampshire has experienced numerous hurricanes and post-tropical cyclones throughout its history. The most significant hurricanes in the recent past were Tropical Storm Irene in 2011 and Hurricane Sandy in 2012. New Hampshire has also experienced "near-misses" with hurricanes when the system has a northerly track towards the State, but recurving away from New Hampshire and out over the Atlantic Ocean. The most recent "near-misses" were Hurricane Joaquin in 2015 (shown below) and Hurricane Hermine in 2016. This northeasterly recurvature of a hurricane's track out over the North Atlantic is the climatological norm for hurricanes in the Atlantic basin.



In 48 hours, the storm went from making a direct impact of New Hampshire to completely missing the east coast all together.

Extent:

The Saffir-Simpson Hurricane Wind Scale is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures[166].

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 kt 119-153 km/h	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 kt 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.

[166] http://www.nhc.noaa.gov/aboutsshws.php

Category	Sustained Winds	Types of Damage Due to Hurricane Winds
3 (major)	111-129 mph 96-112 kt 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 kt 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 kt or higher 252 km/h or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Impacts:

Some of the potential impacts that may occur as a result of a tropical cyclone (depending on its magnitude, track and forward speed) include, but are not limited to:

- Coastal and inland flooding
- Erosion (coastal erosion due to storm surge, and river erosion as result of heavy rainfall)
- Flooding of roadways, roadway washouts, and culvert washouts
- Dam and bridge failures
- Partial or complete damage of buildings
- Extensive vegetative damage
- Loss of utilities for an extensive period of time
- Loss of life and injuries

Although classified as a distinct hazard due to its unique weather pattern, the effects of a tropical cyclone are like other low pressure systems, which may include heavy rainfall and potential flooding, high winds, lightning, tornadoes, and hail.

Coastal flooding information, including models and specific coastal impacts due to tropical and post-tropical cyclones, is detailed and referenced in the Coastal Flooding section of the HIRA.

Previous Occurrences (1958-2018)[167]:

Event Date	Category	Impacts	Location	Additional Information
1858-1934	TD-1	Unknown	Statewide	Between 1858 and 1934, NWS has a record of 17 unnamed storms which ranged from Tropical Depressions to a Category 1 Hurricane that impacted New Hampshire
09/21/1938	3	13 Deaths, 1,363 families received assistance, interruption of electric and telephone services for weeks, 2 billion feet of marketable lumber blown down, flooding throughout the State, in some cases equaling and surpassing the Flood of 1936. Total Direct Losses - $12,337,643 (1938 Dollars) This does not include indirect losses, such as loss of trade and the impact to the timber industry.	Southern New England	The Great New England Hurricane
09/02/1952	TD	Unknown	Southern New England	Hurricane Able
08/31/1954	3	Extensive number of trees blown down and property damage	Southern New England	Hurricane Carol
09/11/1954	3	This hurricane moved off shore but still took 21 lives and caused $40.5 million in damages throughout New England. It followed so close to Carol it made recovery difficult for some areas. Heavy rain in New Hampshire.	Southern New England	Hurricane Edna
07/31/1960	TS	Unknown	New England	Tropical Storm Brenda
09/12/1960	3	Heavy flooding in Massachusetts and Southern New Hampshire.	New England	Hurricane Donna
10/7/1962	TS	Heavy swell and flooding along coastal New Hampshire.	Southern and Central New Hampshire	Tropical Storm Daisy
08/28/1971	TS	Heavy rain and damaging winds	Statewide	Tropical Storm Doria
08/10/1976	1	Rain and flooding	Statewide	Hurricane Belle
09/27/1985	2	This hurricane weakened upon striking Long Island with heavy rains, localized flooding, and caused minor wind damage in New Hampshire.	Statewide	Hurricane Gloria
08/30/1988	TD	Unknown	Coastal New Hampshire	Tropical Storm Chris
08/19/1991	2	3 persons were killed and $2.5 million in damages were suffered along the coast	Coastal New Hampshire	Hurricane Bob
09/16-18/1999	TS	DR-1305 $594,693.82 in public assistance	Statewide	Tropical Storm Floyd
08/26-09/6/2011	TS	DR-4026 $18,091,902.88 in public assistance and $1,262,644.95 in Individual Assistance	Statewide	Tropical Storm Irene
10/29/2012	1	EM-3360 $646,243.08 in Public Assistance and DR-4095 $2,113,605.92 in Public Assistance. 1 fatality in Lincoln.	Statewide	Hurricane Sandy
09/06/2016	1	Closed Hampton Beach due to after effects of Hurricane Hermine made landfall as a TS south of the State, but still had impacts in New Hampshire	Coastal New Hampshire	Hurricane Hermine

[167] https://coast.noaa.gov/hurricanes/

Wildfire

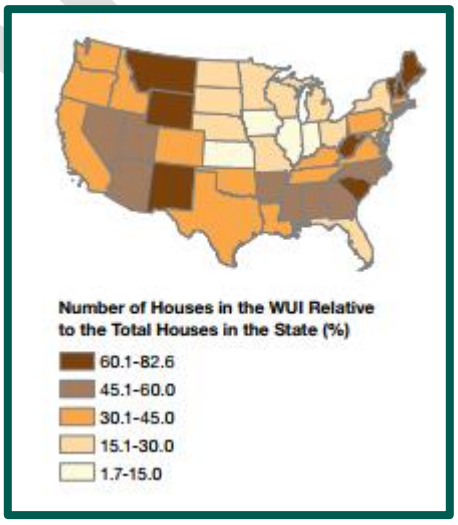
HIRA Risk: Low
Future Probability: Medium
Counties at Risk: All

Definition:
A wildfire is any non-structural fire, other than prescribed fire, that occurs in the Wildland. Wildland here is defined as consisting of vegetation or natural fuels.[168] Wildfires can be referred to as brushfires, wildland fires, or grass fires depending on the location and what is burning.

Location:
The entire State of New Hampshire is at risk for wildfires with increased risk in heavily wooded areas.

Background and evolving hazard information:
New Hampshire is a heavily forested across much of State, leading to an increased risk of wildfires. This risk is exacerbated during times of drought and after natural disasters, which lead to an unusual fuel build up (such as numerous downed trees or buildup of slash and underbrush). The proximity of many populated areas to the State's forested lands exposes these areas and their population to the potential impact of wildfire. Areas that abut and are near wildlands are referred to as being within the Wildland-Urban Interface (WUI). The WUI is a zone where structures and other human developments meet or intermingle with undeveloped wildlands. The WUI is any point where the fuel feeding a wildfire changes from natural (wildland) fuel to manmade (urban) fuel.

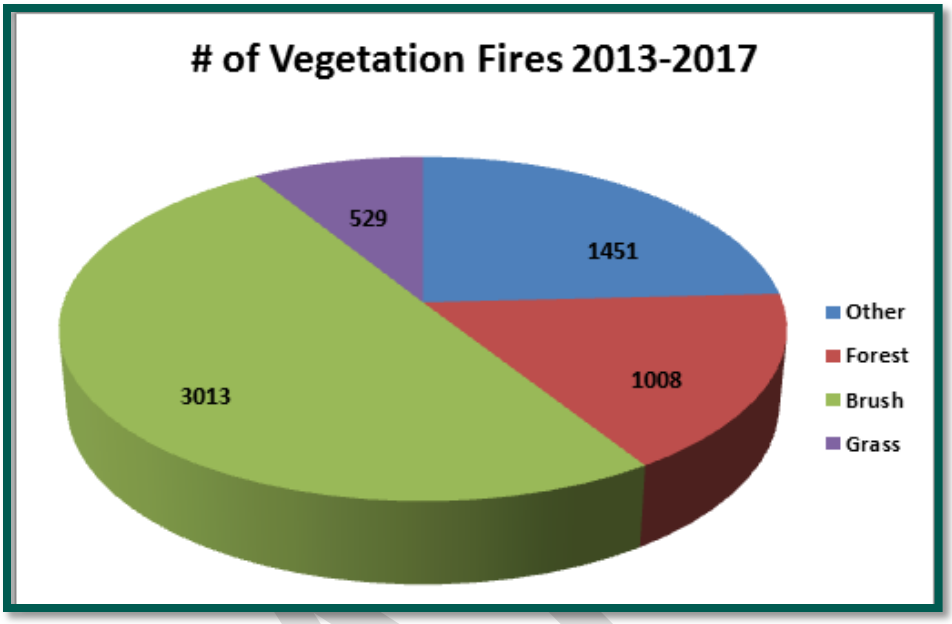
According to the most recent study of aerial photography from 2005 by the US Department of Agriculture's (USDA) Forest Service, the Granite State is the most forested state in the contiguous United States. Forests occupy 88.9% of the State which equates to approximately 5.3 million acres[169]. The southern portion of the State has seen rapid commercial and residential development which has extended into previously forested areas. Although this development has slowed, this sprawl has created its own concerns regarding the increased risk of damage to the wildland-urban interface. A 2010 study by the USDA identified that New Hampshire has the greatest percentage of homes in the WUI out of the total number of homes than any of the other states in the United States, with 82.6% of homes located in the WUI.[170]



According to data from the New Hampshire Fire Incident Reporting System (NHFIRS) provided by the New Hampshire Fire Marshall's Office (NHFMO), there were 6,001 vegetation fires reported between the years of 2013-2017. The majority of these were brush fires, as seen in the pie chart below. The

[168] https://www.nwcg.gov/glossary/a-z#letter_w
[169] http://nhpr.org/post/usda-nh-most-forested-state-union#stream/0
[170] https://www.fs.fed.us/nrs/pubs/rmap/rmap_nrs8.pdf

incidents noted as “other” on the chart are likely miscoded data that belong to the brush and forest categories.



The causes of these fires include debris burning, campfires, arson, children, smoking, and lightning, among others. The 2016 fire season was particularly prolific due to the extreme drought conditions that occurred across the State. During the 2016 season, 1,090 acres were burned, with 330 of those in the Town of Albany (located within the White Mountain National Forest), and 199 acres in Stoddard (located in Cheshire County).

It is not possible to determine the average number of acres burned per year in New Hampshire as the number can vary widely depending on the weather conditions. Typically, the months of April and May experience the highest number of fire starts, with another typically smaller spike of fires in October and November. The reason the majority of fires occur in spring and fall are due to the fact that the forest is predominately made up of hardwood trees, which are sensitive to fire. Fires involving hardwoods typically burn in early spring before green-up, and again in late fall after leaf-drop when fuel sources are elevated. New Hampshire can experience an active summer fire season, but normally this occurs only with an extended period of hot, dry weather resulting in drought-like conditions.

Emergency management personnel survey some of the burned area at the Stoddard fire in 2016.The fire was caused by arson. *(Photo courtesy of the Union Leader)*

While most of the State is covered in northern hardwood forests containing maple, birch and beech, there are numerous smaller "pockets" of high-hazard fuel types scattered throughout the State. These hazardous fuel types include the pitch-pine, scrub oak, spruce-fir, phragmites, and oak-pine forests.

There was an increased incidence of large wildland fire activity in the late 1940s and early 1950s that is thought to be associated, in part, with debris from the Hurricane of 1938. Significant woody "fuel" was deposited in the forests during that event. Large fires burned in rural, suburban, and urban areas, including one fire of over 1,500 acres in Salem and Atkinson, and numerous large fires in Farmington and Rochester which spread in to southern Maine. Large fire activity continued through the early 1950's, and again in the mid-1960's, including a crown fire (a fire that spreads from treetop to treetop) that spread from Brentwood through Exeter and into Kensington. Fire activity in the 1970's and 1980's led to the creation of permanently staffed fire departments in many towns. This new permanent resource, in tandem with exisiting volunteer assets, showed a general decrease in total acreage burned; however, the total number of fire starts actually increased over time.

Concerns of the New Hampshire Department of Natural and Cultural Resources (NH DNCR), Division of Forest and Lands (DFL) include future natural disturbances such as hurricanes, wind events, ice storms, and insect or disease outbreaks that may create a significant amount of woody debris in the forests. A second, weather-related concern is any period of prolonged drought, which makes fire starts more likely and suppression efforts much more difficult. A third concern is the continual sprawl of developed land into historically rural, forested areas. Although this development has slowed in recent years, homes and other valuable resources that are scattered throughout the forest often have limited accessibility and may be some distance from the closest fire department, thereby increasing the danger of damage or destruction from a wildland fire.

NH DNCR-DFL is dedicated to providing resources to local fire departments and promoting educational materials to the public that encourage preventative practices. Examples of these efforts can be seen in the daily publishing of daily fire danger predictions, the Smokey the Bear program, the requirement of burn permits, the staffing of fire towers, and their participation in federal grant programs. NH DNCR, Division of Forests and Lands teams up with the National Weather Service in Gray, ME to utilize forecast data and information from a State owned network of three remote weather stations (located in Lancaster, Bear Brook, and the Saco District of the White Mountains) to produce daily fire weather predictions. These predictions are rated on a scale from Low to Extreme and are made publicly available online, posted outside of local fire departments, and distributed via email to a list serve containing the names of Fire Wardens, Deputy Fire Wardens, and local fire departments who subscribe.

The daily fire danger ratings are as follows[171]:

- Low (Green)—Fire starts are unlikely. Weather and fuel conditions will lead to slow fire spread, low intensity and relatively easy control with light mop-up. Controlled burns can usually be executed with reasonable safety.
- Moderate (Blue)—Some wildfires may be expected. Expect moderate flame length and rate of spread. Control is usually not difficult and light to moderate mop-up can be expected. Although controlled burning can be done without creating a hazard, routine caution should be taken.

[171] https://www.nhdfl.org/Community/Daily-Fire-Danger

- High (Yellow)—Wildfires are likely. Fires in heavy, continuous fuel such as mature grassland, weed fields and forest litter, will be difficult to control under windy conditions. Control through direct attack may be difficult but possible and mop-up will be required. Outdoor burning should be restricted to early morning and late evening hours.
- Very High (Orange)—Fires start easily from all causes and may spread faster than suppression resources can travel. Flame lengths will be long with high intensity, making control very difficult. Both suppression and mop-up will require an extended and very thorough effort. Outdoor burning is not recommended.
- Extreme (Red)—Fires will start and spread rapidly. Every fire start has the potential to become large. Expect extreme, erratic fire behavior. NO OUTDOOR BURNING SHOULD TAKE PLACE IN AREAS WITH EXTREME FIRE DANGER.

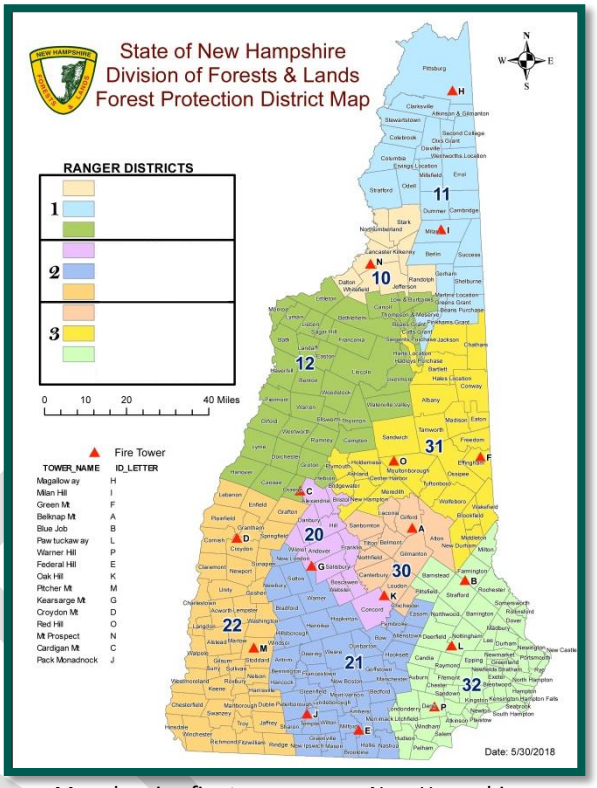
Example of the New Hampshire daily fire danger rating scale. *(Source– Hanover, NH Fire Department)*

Towns use the daily fire danger ratings to determine whether or not they will issue burn permits. In New Hampshire, burn permits are required at any time that there is not complete snow cover on the ground in the area where a person wishes to burn. These permits are used as a preventative measure to limit burning to days when fire danger is reduced and often restricts people to burning after five o'clock in the afternoon when temperatures and humidity values are lower and less likely to promote rapid fire growth and spread. Additionally, these permits offer information printed on them about safe burning practices to educate the public, such as how far a fire should be set back from structures and what types of items are appropriate and safe to burn. Fire permits are typically only given out when the daily fire danger is either low or moderate and are issued in four different categories:

- "Category I fire": A small controlled fire, such as a camp or cooking fire, no greater than 2 feet in diameter contained within a ring of fire resistive material or in a portable fireplace.
- "Category II fire": A controlled fire, such as a camp or cooking fire, no greater than 4 feet in diameter contained within a ring of fire resistive material or in a portable fireplace.
- "Category III fire": Any other fire not a category I or category II fire or a fire greater than 4 feet in diameter or a fire not contained within a ring of resistive material.
- "Category IV fire": A fire, other than a category I fire, that can be kindled between the hours of 9:00 am and 5:00 pm whether raining or not.

In addition to fire permits, NH DNCR-DFL promotes early fire detection and prevention by staffing and maintaining 15 fire towers around the State. These fire towers are open to the public allowing citizens the opportunity to learn about fire prevention while contributing to the observation network by reporting any potential fires that they may see. These fire towers are staffed on class three or above days (High, Very High, or Extreme fire danger). Additionally, NH DNCR-DFL maintains a contract with the Civil Air Patrol (CAP) to enhance their monitoring capabilities. The CAP flies two routes across the State looking for potential fires (shown in the map on the following page).

Local fire departments find an increased need for State personnel, equipment and technical support from the Division of Forests and Lands as fire numbers and incident complexity increases. For example, even though the southern tier of the State experiences the highest number of fires, fires in the northern regions, where the population is minimal, are complicated by poor access and rugged terrain, which greatly hinders efficient and safe response by firefighters. While there are over 8,000 firefighters in New Hampshire, they belong to predominantly volunteer organizations with roughly 1,000 firefighters belonging to permanent departments in larger towns or cities. These volunteer, full-time, or combination fire departments generally specialize in structural fire response and emergency medical services. Though early detection of fires has helped to decrease the total acreage burned, it is common for towns to rely on State support for any incident that involves wildfires greater than a few acres in size.



Map showing fire towers across New Hampshire.
(Source– NH DNCR-DFL)

NH DNCR-DFL supports local communities' needs to equipment through the following programs:

- Federal Excess Personal Property Program (FEPP): This program allows for NH DNCR, Division of Forest and Lands to acquire surplus federal firefighting equipment (such as trucks, tools, apparatus, etc.) and make it available on loan to local communities. The equipment remains the property of the federal government. NH DNCR has provided over two million dollars worth of equipment to the local communities through this program.
- Federal Firefighter Property Program (FFP): This program allows for NH DNCR, Division of Forest and Lands to acquire surplus federal firefighting equipment (such as trucks, tools, apparatus, etc.) and make it available on loan to local communities. There is no cost to the local communities, with the exception that they must maintain the equipment. After a loan period of one year, the equipment becomes property of the local community. NH DNCR has provided approximately one million dollars worth of equipment to the local communities through this program.

Extent:

Currently, there is not a universally adopted scale for measuring wildfires within the State of New Hampshire. There are numerous factors that can be used to describe the severity and complexity of a wildfire:

- Acreage of the fire (size)
- Topography and landscape
- Amount of time required to extinguish the fire
- Environmental factors (drought or wind)

- Damages to urban infrastructure along the WUI, damages to utility infrastructure, or other severe environmental damages
- Amount and types of resources required to extinguish the fire (expressed in number of alarms)

Generally, fire personnel most commonly use the acreage of the fire and the number of alarms to describe the magnitude of thewildfire, as these decriptions are relatable to the size of the fire and number of resources required to extingiush. While this is not an exact science, theses two factors alone are easily understood and allow a straightforward comparison of the magnitude of wildfire events. Some wildfire events that may not easily be described using the severity metrics listed above may include:

- Significant acreage fires that are isolated to a large, flat field which require few resources to extinguish (greater area covered, less alarms needed)
- Small acreage fires that occur in a remote, difficult landscape burning deep into the ground, which often requires a more diversified and coordinated response

The National Wildfire Coordinating Group (NWCG) has developed a fire size classification chart to describe a wildfire by the areal extent in acres:

Size Class of Fire	Size of Fire in Acres
Class A	One-fourth acre or less
Class B	More than one-fourth acre, but less than 10 acres
Class C	10 acres or more, but less than 100 acres
Class D	100 acres or more, but less than 300 acres
Class E	300 acres or more, but less than 1,000 acres
Class F	1,000 acres or more, but less than 5,000 acres
Class G	5,000 acres or more

Impacts:

Wildfires can have extensive impacts on not only the natural environment, but also the economy, air quality, communities, livestock, and quality of human life. Below is a list of potential impacts from wildfires:

- Loss of wildland habitats, forested areas, and sensitive species
- Loss of structures when fires cross of the Wildfire Urban Interface, resulting in homeless peoples and disruption of businesses
- Reduction of air, water, and soil quality post event
- Increased amount of airborne toxins from burning of non-organic materials
- Increased risk of food shortages
- Degradation of land quality and increased risk of soil erosion, landslides, and mudslides (especially when immediately followed by heavy rain)
- Loss of recreational land
- Increase in money required to combat events, resulting in strain on resources
- Loss of cultural and heritage sites
- Increase in insurance premiums

Previous Occurrences:

Event Date	Description	Impacts	Location	Additional Information
1885	Wild River East Fire	3,000 acres burned	Wild River East	
1888	Zealand Valley Fire	12,000 acres burned	Zealand Valley	
1903		84,255 acres burned	Northern New Hampshire	
1907	Lincoln Fire	5,000 acres burned	Lincoln, New Hampshire	
1908	Shelburne Fire	5,060 acres burned	Shelburne, New Hampshire	
1912	Swift River Fire	1,000 acres burned	Conway, New Hampshire	
1914	Rock Branch Fire	10,052 acres burned	Conway, New Hampshire	
1923	Waterville Valley Fire	3,500 acres burned	Waterville, New Hampshire	
1941	Marlow/ Stoddard Fire	27,000 acres burned	Marlow and Stoddard, New Hampshire	
1947		15,242 acres burned	Statewide	
1952	Grantham Fire	1,500 acres burned	Grantham, New Hampshire	
1952	Shaw Mountain Fire	1,500 acres burned	Shaw Mountain, New Hampshire	
1962	Concord Plains Fire	900 acres burned	Concord, New Hampshire	
1963	Kensington/ Exeter Fire	760 acres burned	Kensington and Exeter, New Hampshire	
1984	Table Mountain Fire	100 acres burned	Bartlett, New Hampshire	
1988	Red Hill Fire	262 acres burned	Moultonborough, New Hampshire	
2004	Lucy Brook Fire	140 acres burned	Bartlett, New Hampshire	
2015	Bayle Mountain Fire	275 acres burned	Ossipee, New Hampshire	
2016	Covered Bridge Fire	330 acres burned	White Mountain National Forest in Albany, New Hampshire	
April 2016	Stoddard Brush Fire	199 acres burned	Town of Stoddard	Dozens of firefighters from 22 fire departments battled a six-alarm brush fire that burned 199 acres in the area of routes 9 and 123. 17 families were evacuated from their homes as a precaution.
May 2018	Bow Brush Fire	5 acres burned	Town of Bow	About 60 firefighters were call to the Town of Bow to fight a multiple alarm brush fire in the woods along the Branch Londonderry Turnpike. A breeze and dry conditions made extinguishing the fire challenging.[172]

[172] http://www.wmur.com/article/firefighters-from-multiple-towns-battle-multi-alarm-brush-fire-in-bow/20676011

Aging Infrastructure

HIRA Risk: High
Future Probability: Medium
Counties at Risk: All

Definition:
The continued regression of the State's physical systems including, but not limited to roads and bridges, culverts, utilities, water, and sewage.

Location:
The entire State of New Hampshire is vulnerable to Aging Infrastructure.

Background and evolving hazard information:
Similar to states throughout the Nation, New Hampshire suffers from Aging Infrastructure. The American Society of Civil Engineers released it's 2017 report card bestowing the State with a C - rating overall. [173] The report further identifies that the increase in annual number of vehicle miles traveled has led to more rapid deterioration of roads and bridges. The average lifespan for a bridge is around fifty years, and the current average age of state-owned bridges in New Hampshire is 52-56 years.

The State's dams and wastewater infrastrucure are equally weakening. In 2015, a sinkhole on I-93 North caused major traffic delays in Concord, and in 2016, a water main break in Manchester left a huge hole and caused flooding on Bridge Street.[174]

Previous Occurrences:
Since 2009 113 municipal bridge posting/closure events have occurred due to aging infrastructure.
Over the past ten years, the State has closed/posted the following bridges due to aging infrastructure:

Bridge	Year of Occurrence	Closed/Posted
Stewartstown 054/163 (Bridge St over Connecticut River)	2008	Down-posted to "Weight Limit 10 Tons"
Walpole 062/052 ("Vilas Bridge" – Bridge St over Connecticut River)	2009	CLOSED
Portsmouth 251/108 ("Sarah Long Bridge" – US 1 Bypass over Piscataqua River)	2009	Down-posted to "Weight Limit 20 Tons"
Portsmouth 247/084 ("Memorial Bridge" – US 1 over Piscataqua River)	2009; 2011	Down-posted to "Weight Limit 10 Tons"; CLOSED
New Castle 066/071 (New Hampshire 1B over Little Harbor)	2011	Down-posted to "Weight Limit 15 Tons"

[173] https://www.infrastructurereportcard.org/state-item/new-hampshire/
[174] http://nhpr.org/post/series-new-hampshires-aging-underfunded-infrastructure#stream/0

Bridge	Year of Occurrence	Closed/Posted
Portsmouth 211/114 Stark St over US 1 Bypass)	2013	Down-posted to “Weight Limit 15 Tons”
Lyme 053/112 (East Thetford Road over Connecticut River)	2014	Down-posted to “Weight Limit 15 Tons”
Andover 143/077 (US 4 over Blackwater River)	2014	Reduced to “one lane centered”

New Hampshire continues to employ methods of repairing, replacing, and upgrading aging infrastructure, but obstacles such as funding and staff shortages prove to be a recurring nuisance.

Conflagration
HIRA Risk: Medium
Future Probability: Medium
Counties at Risk: All

Definition:
A large and destructive fire that threatens human life, animal life, health, and/or property. It may also be described as a blaze or simply a (large) fire. A conflagration can begin accidentally, be naturally caused (wildfire), or intentionally created (arson).

Location:
The entire State of New Hampshire is vulnerable to a conflagration.

Background and evolving hazard information:
Conflagations have the potential to cause loss of life, property devasation/destruction, and potential negative economic impacts.

New Hampshire maintains a history of conflagrations dating back to 1930 when the Tuft's Building on the corner of Main Street and Highland Avenue in Plymouth caught fire and burned down including the destruction of Fox Block. It was feared that the entire Town would be lost during the blaze. The damage was estimated to be around $300,000.00.[175]

In 2009, the Alton Bay Christian Conference Center experienced a 14 alarm fire destorying and/or damaging 45 cottages. The blaze required the response of more than 200 firefighters. Officials called it the largest fire handled by the region's mutual aid in almost 40 years.[176]

In an effort to provide proper response and mitigation of these events, the State continues to provide Fire Fighting, Hazardous Materials, Technical Rescue, Driver-Operator, Fire Officer I and II, Industrial Fire Brigade Training, Aircraft Rescue Firefighter NFPA 1003, Fire and Emergency Services Instructure I, II and III, and Fire Inspector I and II certifcation programs through the Division of Fire Standards and Training and Emergency Medical Services (FSTEMS).

Based upon the estimated increase in the State's future growth and development it can be projected that New Hampshire's vulnerability to conflagrations will continue to escalate.

[175] https://www.plymouthfd.org/history
[176] http://www.wmur.com/article/investigators-search-for-cause-of-alton-fire/5161198

Dam Failure
HIRA Risk: Medium
Future Probability: Medium
Counties at Risk: All

Definition:
Dam Failure is defined as the sudden, rapid, and uncontrolled release of impounded water.[177]

Location:
New Hampshire is vulnerable to Dam Failure throughout the State dependent upon existing locations and inundation areas.

Background and evolving hazard information:
The New Hampshire Department of Environmental Services (NHDES), through its Dam Bureau, is responsible for the regulation of the State's dams to ensure that they are constructed, maintained, and operated in a manner to promote public safety. This is accomplished through the review, approval, and permitting of plans, specifications for the construction and reconstruction of dams, as well as the regular inspection of all dams that pose a hazard to downstream lives or property.

There are a total of 2,622 dams in the State of New Hampshire that are subject to New Hampshire's Dam Safety Rules, and an additional 32 federally-owned dams that are not subject to New Hampshire's Dam Safety Rules. Of the 2,622 active dams 1,782 are classified as Non-Menace, 524 as Low, 157 as Significant and 159 as High. The State of New Hampshire owns 251, with 70 classified as Non-Menace, 92 as Low, 33 as Significant and 56 as High. Currently, to be subject to State jurisdiction, dams must be over 6' in height or meet other specific criteria. The State of New Hampshire also owns and is responsible for another 27 impounding structures which are less than 6 feet in height.

Although they have occurred, dam failures resulting in notable downstream damages are not common in New Hampshire. Damages to dams themselves are more frequent, oftentimes resulting from an unusually heavy rain event or a rain event that produces significant discharge through spillways and outlets and causes related erosion to adjacent embankment sections or discharge channels. The most likely failure mechanism is related to overtopping – when the runoff produced from a storm event exceeds the maximum capacity of a dam's outlet works. In such cases, the dam will likely be overtopped, that is, have water flow over or through areas that are not designed to pass water. This condition generally leads to erosion damage to earthen sections and difficulty to owners and respondents in getting access for operation, and can cause complete failure of the dam.

Dams can also fail due to poor design and/or construction, as well as from poor or inadequate maintenance. These types of failures are less common, which may be the result of the generally high degree of dam owner stewardship and the State's permitting regulations and periodic inspection program. Some notable failures have occurred, however, and information related to some of these is provided below.

[177] National Oceanic and Atmospheric Administration (NOAA), Hydrological Terminology (2014)

Another flooding potential relating to dams has to do with improper manipulation of the dams' discharge or outlet works. This can occur both during dry (normal) conditions as well as during flood events. It is extremely important for dam owners to understand the impacts related to both routine and emergency operations. NHDES works with both owners and local response officials to insure that information and data are available and properly communicated so that all parties are making informed decisions based upon ongoing conditions and potential impacts.

Within the State of New Hampshire dams are categorized into one of four classifications, which are differentiated by the degree of potential damages that a failure of dam is expected to cause. The classifications are designated as Non-Menace, Low Hazard, Significant Hazard, and High Hazard.

Non-Menace Structure
A non-menace structure is a dam that is not a menace because it is in a location and of a size that failure or misoperation of the dam would not result in probable loss of life or loss to property, provided the dam is:

- Less than six feet in height if it has a storage capacity greater than 50 acre-feet; or
- Less than 25 feet in height if it has a storage capacity of 15 to 50 acre-feet.

Low Hazard Structure
A low hazard structure is a dam that has a low hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in any of the following:

- No possible loss of life.
- Low economic loss to structures or property.
- Structural damage to a town or city road or private road accessing property other than the dam owner's that could render the road impassable or otherwise interrupts public safety services.
- The release of liquid industrial, agricultural, or commercial wastes, septage, or contaminated sediment if the storage capacity is less than two-acre-feet and is located more than 250 feet from a water body or water course.
- Reversible environmental losses to environmentally-sensitive sites.

Significant Hazard Structure
A significant hazard structure **is** a dam that has a significant hazard potential because it is in a location and of a size that failure or misoperation of the dam would result in any of the following:

- No probable loss of lives.
- Major economic loss to structures or property.
- Structural damage to a Class I or Class II road that could render the road impassable or otherwise interrupt public safety services.
- Major environmental or public health losses, including one or more of the following:
    - Damage to a public water system, as defined by RSA 485:1-a, XV, which will take longer than 48 hours to repair.
    - The release of liquid industrial, agricultural, or commercial wastes, septage, sewage, or contaminated sediments if the storage capacity is 2 acre-feet or more.
    - Damage to an environmentally-sensitive site that does not meet the definition of reversible environmental losses.

High Hazard Structure

A high hazard structure is a dam that has a high hazard potential because it is in a location and of a size that failure or misoperation of the dam would cause probable loss of human life as a result of:

- Water levels and velocities causing the structural failure of a foundation of a habitable residential structure or commercial or industrial structure, which is occupied under normal conditions.
- Water levels rising above the first floor elevation of a habitable residential structure or a commercial or industrial structure, which is occupied under normal conditions when the rise due to dam failure is greater than one foot.
- Structural damage to an interstate highway, which could render the roadway impassable or otherwise interrupt public safety services.
- The release of a quantity and concentration of material, which qualify as "hazardous waste" as defined by RSA 147-A:2 VII.
- Any other circumstance that would more likely than not cause one or more deaths.

Inspections

All hazardous dams in the State are inspected at regular intervals according to their assigned hazard classification. Inspections include a review of design, repair and maintenance history, detailed visual assessments of all dam components and a review of areas downstream of the dam to identify the potentially affected development that exists.

Hazard Classification	Inspection Interval in Years
High	2
Significant	4
Low	6
Non Menace – if certain height and/or storage criteria are met	6 [178]

Notable Previous Occurrences of Dam Failures:

As noted above, there have been a very limited number of dam failures in the state's history, and many of these resulted in damages only to the dam's themselves or the dam owner's immediate property. One, the 1996 failure of Meadow Pond Dam in Alton, resulted in the loss of life.

New Hampshire Significant Dam Failure Events			
Name	**Year**	**Hazard Classification**	**Cause of Failure**
Weeks Pond Dam, Warren New Hampshire	July 2017	Low	Overtopping failure and wash-out of earthen embankment
Deer Run Pond Dam, Campton New Hampshire	April 2017	Low	Non-overtopping, structural failure of outlet works/ internal erosion.

[178] https://www.des.nh.gov/organization/commissioner/pip/factsheets/db/documents/db-15.pdf

Name	Year	Hazard Classification	Cause of Failure
Nottingham Lake Dam, Nottingham New Hampshire	May 2006	Low	Overtopping failure and wash-out of earthen embankment.
Ashuelot Paper Mill Dam, Winchester New Hampshire	October 2005	Low	Overtopping failure and wash-out of earthen embankment.
Lower Robertson Dam, Winchester New Hampshire	October 2005	Low	Overtopping failure and wash-out of earthen embankment.
Ox Bow Campground Dam, Hillsborough New Hampshire	April 2004	Non-Hazardous	Overtopping failure and wash-out of earthen embankment.
Cold Brook Pond Dam, Lempster New Hampshire	October 1996	Significant	Progressive and complete erosion of the vegetated auxiliary spillway due to high flows through spillway.
Meadow Pond Dam, Alton New Hampshire	March 1996	Significant	Non-overtopping, structural failure/internal erosion.
Nash Bog Pond, Odell New Hampshire	May 1969	Significant	Non-overtopping, structural failure/internal erosion.
Abenaki Lake Dam, Dixville New Hampshire	April 1960	Significant	Non-overtopping, structural failure/internal erosion.

Hazardous Materials

HIRA Risk: Low
Future Probability: Medium
Counties at Risk: All

Definition:
A hazardous material is any item or agent (biological, chemical, radiological, and/or physical), which has the potential to cause harm to humans, animals, or the environment, either by itself or through interaction with other factors.[179]

Location:
The entire State of New Hampshire is vulnerable to Hazardous Materials.

Background and evolving hazard information:
Hazardous materials are defined and regulated in the United States primarily by laws and regulations administered by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC).

Hazardous Materials continue to evolve as new chemical formulas are created. This requires constant oversight to ensure our first responders are educated on the new chemicals, their characteristics and how to respond to incidents involving them. With the continuing development of new alternative fuels, we have to adapt to new fire suppression methods for these hazardous materials due to existing fire suppression methods being ineffective. New methods for illegal drug production have increased the potential for fires caused by reactivity between the different hazardous materials involved in the process. Additionally, the current opioid crisis impacting the State has resulted in the creation and continual need for training emergency responders in the appropriate and safe handling of potentially lethal substances such as Fentanyl.

Notable Previous Occurrences:

Hazardous Material Events		
Date	**Location**	**Damages and Impacts**
December 24, 2009	Durham	DHHS was notified of a confirmed case of gastrointestinal Anthrax in the State. DHHS, along with New Hampshire Department of Public Health, New Hampshire Department of Environmental Services, Town of Durham, CDC, FBI, 12th CST, and the Seacoast Regional HazMat Team (START) worked to identify and test suspect areas to look for the source. The Center for Disease Control stated this was the first case of gastrointestinal Anthrax in the United States. This event is anticipated to end with the Final After Action report sometime in August. Being the first of its kind in the US, we did not have any previous history on how this was going to react and how we were going to control the situation.

[179] https://www.ihmm.org

Date	Location	Damages and Impacts
February 12, 2012	Hinsdale	A Tritium leak at Vermont Yankee Nuclear Power Plant. An initial meeting was established with New Hampshire Public Health, NH RAD, HSEM, and NHDES to review the situation and set up a technical team to sample areas of concern in Hinsdale, New Hampshire. Our HazMat coordinator assisted in the formation of the team, PPE selection and participated as the Safety Officer for the sampling program which is still ongoing.
January 5, 2011	Andover	Dioxide incident at Procter Academy hockey arena
July 12, 2011	Hopkinton	Boat explosion
September 29, 2011	Cheshire County	Numerous hazardous materials floating in Connecticut River near Chesterfield/Hinsdale, due to heavy rains
May 2, 2012	Lebanon	Chemical reaction due to mixed hazardous waste inside commercial facility
June 28, 2012	Manchester	Leaking dangerous chemical inside tractor trailer.

Fire and Hazardous Material (HAZMAT) incidents continue to occur frequently around the State. New Hampshire's changing population and businesses necessitate the need to continuously improve our efficiency in providing lifesaving services as well as property protection and environmental preservation to citizens and visitors.

Known and Emerging Contaminates

HIRA Risk: High
Future Probability: High
Counties at Risk: All

Definition:
Contaminants in drinking water include naturally occurring contaminants associated with the geology in a given region and known man-made contaminants associated with nearby land use activities. Some contaminants are considered emerging contaminants. Emerging contaminants are chemicals that historically have not been monitored for in drinking water due to the lack of laboratory capabilities to detect the compounds or a lack of knowledge about the use of certain compounds and their potential to cause human health impacts. Emerging contaminants are particularly concerning to the public because the potential health impacts of these are sometimes uncertain.

Location:
The drinking water for the entire State of New Hampshire is at risk for natural and man-made contaminants. Fifty-five percent of New Hampshire's population obtains its drinking water from federally and State regulated public water systems and the remaining 45 percent of residents rely on private, household drilled or dug wells for their drinking water supply. State and federal agencies have conducted studies in New Hampshire that map the probability of detecting unsafe levels of many natural contaminants in groundwater throughout the State. These studies are not an adequate substitute for actually testing at an individual drinking water source because natural contaminants can occur in groundwater anywhere in New Hampshire. Additionally, NHDES actively oversees the monitoring and management of all locations where contamination has been detected in groundwater at elevated levels. Lastly, recent discoveries of emerging contaminants in New Hampshire show that groundwater and surface water sources of drinking water near certain types of industries or contamination sites are at an increased risk for contamination.

Background and evolving hazard information:
Emerging contaminates have become a topic of increased political debate and scientific study across the Country following the Flint, Michigan water crisis that occurred as a result of a decision to change the source of their public drinking water supply. The new water source was corrosive in nature and, when fed through the aged lead supply pipes, caused contamination of the drinking water throughout much of the town.

The NHDES estimates that more than 46 percent of New Hampshire residents rely on private wells for drinking water at home. While homes served by a public water supply benefit from federal regulations requiring regular testing for contaminants, it is the responsibility of private well owners to regularly test their water source and, if needed, treat their well water. Certain contaminants found in New Hampshire's groundwater occur naturally due to geologic or soil conditions, while others are associated with human activities. For example, arsenic and radon are common contaminants found in bedrock and, consequently, in well water. Potential human sources of contamination include leaking underground fuel tanks, chemical spills, closed landfills, road salt and other land uses. Regardless of the source of contamination, water must be tested and treated to ensure it is safe to drink.

Naturally Occurring Contaminants

Trace elements, such as arsenic, lead, manganese and uranium can be particularly worrisome when found in drinking water obtained from private wells. Recently, the U.S. Geological Survey (USGS) and U.S. Environmental Protection Agency (EPA) New England conducted a trace metals study on 232 private well water samples in southeastern New Hampshire.

The key findings in this study included the following:

- Nearly 3 out of 10 (28 percent) of water samples contained trace metal concentrations that exceeded one or more of the U.S. EPA's drinking water standards.
- As of 2010, estimates of the numbers of residents in the study area that may have private wells in bedrock aquifers that supply water with trace-metal concentrations exceeding the standards are as follows:
    - 8,600 people have lead exceeding 15 µg/L
    - 7,500 people have uranium exceeding 30 µg/L
    - 14,900 people have manganese exceeding 300 µg/L

Exposure to contaminants through drinking water can have a variety of adverse health effects. Some contaminants, such as certain strains of *E.coli* bacteria or high levels of nitrates, can result in immediate illness, such as gastroenteritis. Other contaminants, when consumed over a long period of time at low doses, increase the risks for developing certain forms of cancer, cardiovascular diseases, and neurological disorders.

Among potential private well water contaminants, arsenic is of particular concern in New Hampshire. Arsenic has been linked to cancer in humans. Based on the potential adverse effects of arsenic on the health of humans and the frequency and level of arsenic occurrence in public drinking water systems, the EPA has set the arsenic maximum contaminant level (MCL) for public drinking water systems at 10 parts per billion (ppb).

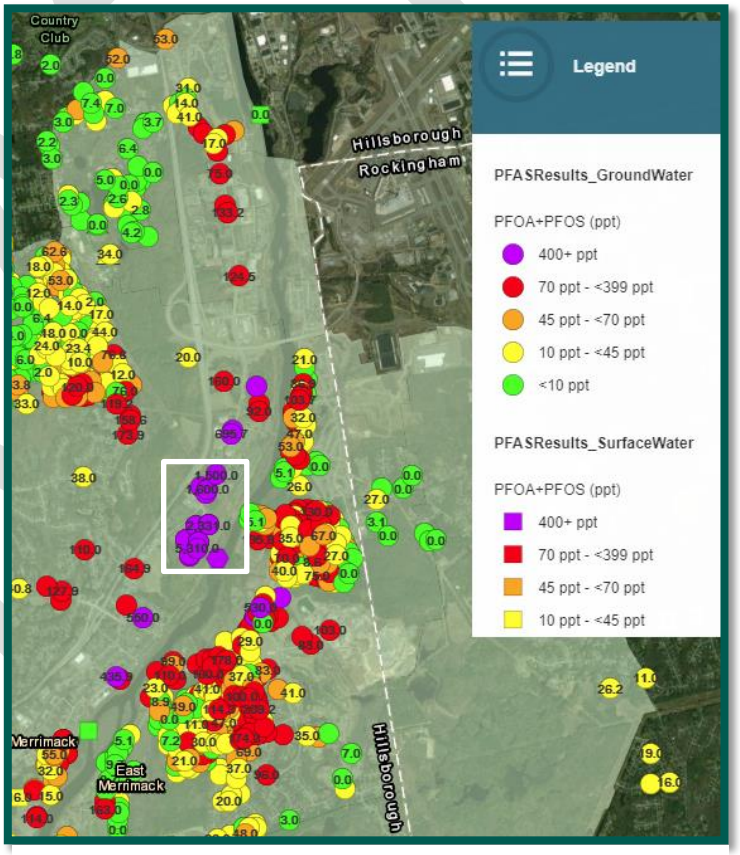
Arsenic is naturally occurring and quite common in New Hampshire's groundwater, and health studies of New Hampshire residents have demonstrated the connection between arsenic and the increased prevalence of conditions such as bladder and other cancers and developmental effects on children. More than one-third of the community water systems in New Hampshire have a measurable amount of arsenic in their water. The U.S. EPA typically sets MCLs for drinking water contaminants at a level at which a lifetime of exposure would result in one excess cancer in 1,000,000 (one million) people exposed. However, the U.S. EPA makes exceptions in cases where the technology is not readily available to detect the contaminant at extremely low levels or to remove the contaminant (treat the water) to such low levels. For some contaminants, the U.S. EPA has established drinking water MCLs with cancer risks in the 10-in-a-million to 100-in-a-million range. The 10 ppb MCL for arsenic is associated with a far greater risk, 3,000 in a million (roughly 1 in 300). A 2014 report by researchers at Dartmouth College estimated that exposure to arsenic in drinking water from private wells can be blamed for 830 cancer cases in the current population. The report also stated that nearly half of private well users have never tested their water for arsenic (Borsuk, et al. 2015: Arsenic in Private Wells in NH). There may be 41,000 people in just the counties of Merrimack, Strafford, Hillsborough, and Rockingham who are drinking water with arsenic levels above the EPA standard.

Man-made Contaminants

Man-made chemicals that have been historically recognized to impact some groundwater and surface water sources of drinking water include volatile organic compounds, pesticides, semi-volatile compounds, radionuclides, nitrates/nitrites, metals and radionucludes. Sites where these chemicals have been detected or known to have been released are managed under a comprehensive regulatory program that ensures nearby sources of water are not contaminated or that contaminated sources of drinking water are mitigated. The regulatory program also develops a remedial response plan to restore surface and groundwater quality.

Emerging Contaminants

Emerging contaminates have been detected in surface and groundwater that are sources of drinking water in the State of New Hampshire, and citizen awareness of this issue has grown exponentially in recent years. The latest incidents in New Hampshire to garner widespread media and public attention were related to the discovery of poly and perfluoroalkyl substances, more commonly referred to as PFAS, at unusually high levels in groundwater derived from one public water supply well at the Pease Tradeport in Newington, NH. These compounds were also found in private and public water supply wells surrounding the Saint Gobain Performance Plastics Plant (SGPP). An investigation[180] into this issue began in March of 2016 after SGPP notified the New Hampshire Department of Environmental Services (NHDES) of PFOA contamination in samples taken from water faucets at the plant that were served by the Merrimack Village District Water System. The results of a NHDES study released in January of 2017 showed that of 1,619 wells tested across southern New Hampshire, 222 reported contamination of greater than or equal to 70 ppt. Of these 222 water sources that were tested above the 70 ppt threshold, 183 were found in the Saint Gobain investigation area, which included Bedford, Litchfield, Londonderry, Manchester, and Merrimack.[181] This investigation was ongoing at the time of this writing, and legal proceedings were in process to find permanent solutions for citizens with drinking water supplies found to be contaminated.



Water samples taken by NHDES that tested for PFAS, a type of PFC, near the SGPP (located within the white box). Samples colored red and purple are above the State safe drinking water threshold of 70 ppt. *(Courtesy of NHDES)*

[180] https://www4.des.state.nh.us/nh-pfas-investigation/

[181] https://www.des.nh.gov/organization/commissioner/documents/pfoa-statewide-status-20170110.pdf

PFAS are a class of chemicals that consists of thousands of compounds. In 2009, the U.S. EPA developed health advisories for two PFAS compounds, PFOA and PFOS of 200 and 400 parts per trillion (ppt), respectively. In 2016, the U.S. EPA issued new health advisories for PFOA and PFOS of 70 ppt for PFOA and PFOS combined. The revised health advisory is significantly lower than the 2009 health advisory. The 2016 health advisory states that short-term exposure to PFOA and PFOS in drinking water above 70 ppt poses a health risk to susceptible populations. The potential for adverse human health impacts when PFOA and PFOS combined are above 70 ppt in drinking water requires rapid response actions to ensure that consumption of the contaminated water ceases and that an alternative supply of drinking water be provided.

Historically, other emerging contaminates have spiked public concern, including Methyl Tertiary Butyl Ether (MtBE), which is a manufactured chemical used to increase the octane rating of gasoline. MtBE degrades slowly and is highly soluble in water, allowing it to spread further and last longer in groundwater than many other contaminates.[182] This chemical was used as an additive in gasoline until 2007, but was still detected in approximately 10% of randomly tested wells in southeastern New Hampshire.[183]

Not all emerging contaminants are directly associated with man-made chemicals. Increased land development and more intense precipitation trends are increasing nutrient loading in a number of surface water bodies that are sources of drinking water for public water systems. Increased nutrient loading coupled with warming temperatures have caused harmful algal blooms to form in surface water bodies. If the blooms release harmful algal toxins and impact the water at the intake of the public water system, there is a concern that existing drinking water treatment systems may not be adequate to remove the toxins.

Extent:

There is no universal standard for all types of emerging contaminates; however, environmental services agencies typically measure the presence of chemicals in water sources in parts per billion or trillion—ppb and ppt, respectively. Safe drinking water thresholds for many chemicals are set by either the EPA or NHDES to protect human health; however, new emerging contaminates will require scientific study to determine what level, if any, is safe for human consumption. These contaminate thresholds can change as the health impacts of exposure at different levels are observed over time.

Impacts:

The impacts of known and emerging contaminates include, but are not limited to:

- Damage to the environment, including impacts to health of aquatic life and animals living in the area
- The need to find alternative sources of drinking water or installing more robust water treatment equipment to remove the contaminants
- Reduction of both private and public land value

[182] https://www.des.nh.gov/organization/commissioner/pip/factsheets/dwgb/documents/dwgb-3-19.pdf
[183] https://www.des.nh.gov/organization/commissioner/pip/newsletters/en/documents/2017-mar-apr.pdf

- Restrictions on recreational use of public water sources (example: In March of 2018, NH Fish and Game notified the public to avoid eating fish caught in rivers near the Seacoast due to chemical contamination concerns. This restriction included the several thousand brown trout that are stocked yearly in Berry's Brook in Rye, NH, which runs near the Coakley Landfill.[184])
- An increased risk for adverse health effects, including cancers, fertility issues, developmental delays in children, lower immune system function, and other conditions

Previous Occurrences:

Event Date	Description	Impacts	Location	Additional Information
Ongoing	Natural Contaminants in Private Wells	Increased risk for adverse health effects	Statewide	Natural contaminants can be present at unsafe concentrations in private wells. There is no requirement for private well owners to test and ensure their water is safe to drink. NHDES has provided a substantial amount of information to the public regarding how to test and treat private wells to ensure drinking water is safe.
Ongoing	Manmade and Emerging Contaminants in groundwater and surface water	Increased risk for adverse health effects if the water is consumed Recreational use restrictions Impact on property values	Statewide	Hundreds of sites throughout New Hampshire have detected unsafe concentrations of chemicals associated with human activities. As these sites are discovered, an environmental site investigation is completed and if necessary, a plan to remediate the contamination is developed and implemented.

[184] http://nhpr.org/post/fish-game-warns-anglers-not-eat-fish-rye-river-near-superfund-site#stream/0

Long-Term Utility Outage

HIRA Risk: Medium
Future Probability: High
Counties at Risk: All

Definition:

A long-term utility outage is defined as a prolonged absence of any type of public utility that is caused by infrastructure failure, cyber-attack, supply depletion, distribution disruption, water source contamination, or a natural, human caused or technological disaster. This hazard is new to the 2018 SHMP update and was identified as a rising area of concern at the initial stakeholder meeting held in April of 2017. For the purpose of this plan, the State will consider a long-term utility outage as one lasting a month or more, or a prolonged outage that causes extreme cascading impacts.

Location:

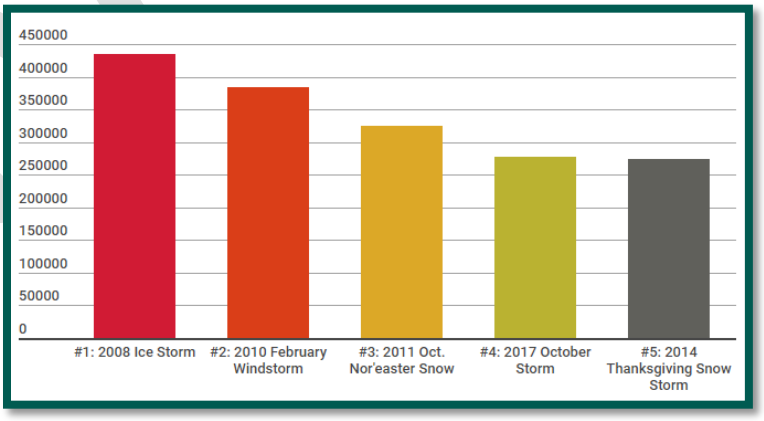
The entire State of New Hampshire is at risk for a long-term utility outage.

Background and evolving hazard information:

Utility outages in the State of New Hampshire are often thought of as being power outages and typically are short lived. That said, the State has experienced and continues to be at risk for long-term utility outages. Types of public utilities that are common in the State can be broken down in four general categories, listed below:

- Power/Electricity: Bio gas, coal, hydroelectric, nuclear, solid waste, wind, geothermal and solar
- Heat/Fuel: Natural gas, propane, heating oil, kerosene, and wood
- Water Supply: Public water districts, private wells, lakes, ponds, rivers, and streams
- Communications: Internet, cable (fiber optic lines), land lines (both fiber optic and copper lines), and satellite

Some of these public utility sectors overlap, but a disruption of any duration to these critical resources causes potential life safety issues to the public. Furthermore, outages of any utility for an extended period of time can lead to cascading effects such as runs on grocery stores, decreased local economy (due to point of sale systems and banks being out of commission), disruption of emergency communications, and many more.



Top 5 power outages in New Hampshire history. Data provided by NH HSEM. Figure courtesy of NHPR.

Power outages are the most common utility disruptions in New Hampshire, and they often are the result of strong coastal lows, Nor'easters, and severe thunderstorms. These outages are typically short-lived, but can persist depending on the severity of the weather event. Historically, the State has seen the top 5 largest power

outages in its history within the last decade[185], the largest and longest of which being the Ice Storm of 2008 that left some New Hampshire residents without power for over two weeks. Three out of five of these severe storms resulted in federally declared disasters for the State.

A meteorological cold wave that began on December 26th 2018 led to prolonged, below average temperatures across the State led to an increased demand in heating oil in early January of 2018. Although there was no shortage of heating oil in the State, there were not enough delivery drivers to keep up with the increased demand.[186] A State Call Center was established to prioritize calls for assistance and help relay high level cases directly to fuel companies. Even with the Call Center in place and a waiver signed by the Governor that extended the number of allowable driving hours for delivery personnel, New Hampshire residents faced a wait time in excess of two weeks in some cases. Runs on gas stations with diesel fuel were made, since diesel can supplement heating oil systems during a shortage, and some gas stations in northern New Hampshire ran out of diesel as a result. A warming to more seasonal temperatures in the second week of January brought an end to the cold wave and eventually allowed for the system to catch up on deliveries.

Other potential sources of long-term utility outages include emerging contaminates, which impact drinking water *(see the emerging contaminates section)*, and cyber-attacks on any type of utility infrastructure *(see cyber event section)*.

Cascading impacts following a long-term utility outage have the potential to be significant and widespread. In the case of electricity, New Hampshire is particularly vulnerable because the electrical grid is tied in to the other states within New England; therefore, if one state is impacted heavily, the others will likely be as well. Additionally, the mutual aid resources that are needed to recover will not be available as they will already be at work in their own state. This issue of limited resources has already been seen in severe winter storms that cause more routine large power outages. Other states and Canada will send resources, but they can only stay for a limited time before they must return home. Additionally, it is likely that the supply of other utilities (gas, communications, etc.) will also be impacted because the network for delivery and supply is tightly connected across New England.

Major concerns for cascading impacts include, but are not limited to:

- Transportation impacts and shortage of goods
- Scramble for resources by the public
- Food shortages, including limited to no ability to store perishable foods
- Inability to transport and deliver fuel
- Limited or absent primary and secondary communications, including emergency communications

New Hampshire does not have a State level response plan for a long-term utility outage; however, individual utility companies (gas and electric) are required to have plans in place to respond to long-term outages. The Public Utilities Commission (PUC) assists in managing those plans and provides incident support when necessary.

[185] http://nhpr.org/post/top-5-power-outages-new-hampshire#stream/0
[186] http://www.concordmonitor.com/Prolonged-cold-weather-in-NH-14653778

The State is currently collaborating with FEMA Region I and many other regional and federal stakeholders to create a Regional Power Outage Incident Annex (RI POIA) that will provide a regional framework to maximize response effectiveness and prepare for recovery operations following a large scale, long-term power outage in the Northeast United States. This plan will support the joint Region I, II, and II Northeast Power Outage (NEPOP) Base Plan by providing Region I specific information about response actions during a long-term power outage.

Extent:

There is no universal method for measuring the extent of utility outages; however, proxy data can be used to determine the extent or area impacted during an outage. These factors include, but are not limited to:

- Number of customers without power, services, fuel, cable/internet, etc.
- Size of the area experiencing an outage
- How long customers have been without a utility and how long they can expect to be without that resource
- Whether or not local and State resources were completely expended, requiring federal assistance
- Extent of cascading impacts

An event is typically referred to after the fact as the greatest extent experienced, i.e. the greatest number of customers without power throughout the incident.

Impacts:

The impacts of utility outages can be either localized or widespread, and include, but are not limited to:

- Residents without power, heat, fuel, and/or communications
- Runs on other resources, such as grocery stores, gas stations, and ATMs
- Disruption of public transportation system, including buses, trains, and airports
- Decrease in local economy as stores are unable to operate without power and close

Previous Occurrences: There are no previous occurrences on record for the State of New Hampshire that meet the threshold of the plan (one month or more); however, notable events where a utility outage has impacted the State and resulted in a significant coordinated response are listed below.

Event Date	Description	Impacts	Location	Additional Information
January 1998	Ice Storm of 1998	Heavy ice accumulation across New England, leading to millions of power outages across the region	Northern, Eastern, and Central New Hampshire[187]	A strong low pressure system and persistent cold air near the surface created prime conditions for ice accretion. Ice accumulations of over 0.5 inches were observed across the State with observations of up to an inch seen in southern New Hampshire. Extensive tree damage was observed and left roughly 440K customers without power.[188]

[187] https://extension.unh.edu/resources/files/Resource000987_Rep1131.jpg

[188] https://www.puc.nh.gov/2008IceStorm/Final%20Reports/2009-10-30%20Final%20NEI%20Report%20With%20Utility%20Comments/Appendix%20D%20-%20CRREL%20Report.pdf

Event Date	Description	Impacts	Location	Additional Information
December 2008	Ice Storm of 2008	Widespread accumulations of ice across the State causing a long term power outage	Statewide	This ice storm caused the most extensive power outage in New Hampshire history leaving approximately 433K customers without power. Some customers were not restored for roughly two weeks. The restoration effort cost over $78M dollars.
February 25 – March 4, 2010	Wind Storm	Anomalous winter storm brought heavy rain, snowfall, and extreme winds, causing a large scale power outage	Statewide	A strong low pressure system moved over New England causing widespread high wind gusts that led to the second largest power outage (~338K customers) in New Hampshire history. It took roughly six days to restore power to customers. Seabrook Station saw a 2 meter wind gust of 94 mph.[189]
August 28 – September 1, 2011	Tropical Storm Irene	Strong tropical storm brought high winds, heavy rain, and coastal and inland flooding to the State, leading to extensive power and communications outages	Statewide	The center of Tropical Storm Irene moved just southwest of New Hampshire and brought a prolonged period of strong winds and heavy rain to the State. Many rivers saw 100 year flood events which destroyed historic wooden covered bridges. Roughly 184K NH customers were without power and the restoration effort took approximately 3.5 days to complete.
October 29 – November 4, 2011	Nor'easter – "Snowtober"	An early season winter storm brought large accumulations of wet, heavy snow to the State	Statewide	Heavy snow led to numerous downed trees and power lines across New Hampshire, causing roughly 300 K power outages, the third largest in the State's history.
October 26 – 31, 2012	Tropical Storm Sandy	A strong tropical storm brought widespread strong winds and heavy rain to the State	Statewide	A strong tropical storm caused 190K customers to lose power. It took almost 5 days to restore power and cost the power companies almost $18M dollars.
January 2014	Fred Fuller	The Fred Fuller oil company was unable to complete fuel deliveries to numerous customers resulting in a shortage during the winter season	Statewide	Fred Fuller, a primary fuel oil supplier for the State, was unable to fulfill automatic deliveries for their customers who had pre-paid for the 2014 winter season. Residents across the State (especially in southern and central New Hampshire) began to run out of fuel and had to be referred to other companies. The company has since dissolved and new legislation was introduced in an effort to prevent recurrence of similar incident.
October 29 - November 4, 2017	Severe Rain and Wind Storm	A low pressure system merged with the remnants of Tropical Storm Philippe and moved northeastward, causing high winds and heavy rain	Statewide	Heavy rain and high winds caused flash and riverine flooding, especially in the White Mountains. Preexisting wet soil conditions and wind gusts in excess of 55 mph inland and 80 mph along the coast snapped and uprooted trees and downed power lines, leading to roughly 290K power outages that took a week to restore.

[189] https://www.weather.gov/media/erh/ta2013-03.pdf

Event Date	Description	Impacts	Location	Additional Information
March 2018	Winter Storm	High winds caused communications and connectivity failures	New Hampshire Seacoast	Major communications line that runs across (WHAT BRIDGE?) the Piscataqua River was knocked down due to high winds, cutting off (911 communications and cable internet connectivity to portions of Maine and New Hampshire for several hours while the line was restored.

Radiological

HIRA Risk: Low
Future Probability: Low
Counties at Risk: All

Definition:
Radiological hazards can range from relatively localized incidents involving small amounts of radioactive materials to large-scale catastrophic events. Smaller sources of radiation hazards may be found in medical facilities, industrial, and laboratory facilities where radioactive materials and/or radiation producing devices are used. Some radiation is produced naturally from decomposition of radioactive isotopes in soils and underlying strata.

Location:
All facilities throughout the State of New Hampshire are vulnerable to a radiological accident.

There are two planning zones specific to the Seabrook Station Nuclear Power Plant. The Plume Exposure Pathway is the 10-mile radius around the plant and the ingestion pathway is a 50 mile radius that includes the following 96 communities:

Plume & Ingestion	Ingestion Only			
Brentwood	Allenstown	Derry	Litchfield	Pembroke
East Kingston	Alton	Dover	Londonderry	Pittsfield
Exeter	Amherst	Dunbarton	Loudon	Plaistow
Greenland	Atkinson	Durham	Lyndeborough	Raymond
Hampton	Auburn	Epping	Madbury	Rochester
Hampton Falls	Barrington	Epsom	Manchester	Rollinsford
Kensington	Barnstead	Farmington	Mason	Salem
Kingston	Bedford	Francestown	Merrimack	Sandown
New Castle	Belmont	Fremont	Middleton	Somersworth
Newfields	Boscawen	Gilford	Milford	Strafford
Newton	Bow	Gilmanton	Milton	Wakefield
North Hampton	Brookfield	Goffstown	Mont Vernon	Weare
Portsmouth	Brookline	Greenfield	Nashua	Webster
Rye	Candia	Greenville	New Boston	Wilton
Seabrook	Canterbury	Hampstead	New Durham	Windham
South Hampton	Chester	Henniker	Newington	Wolfeboro
Stratham	Chichester	Hollis	Newmarket	
Host Sites	Concord	Hooksett	Northfield	
Rochester Middle School	Danville	Hopkinton	Northwood	
Dover Middle School	Deerfield	Hudson	Nottingham	
Manchester Memorial High School	Deering	Lee	Pelham	

Background and evolving hazard information:

Although frequently considered a type of hazardous material, radioactive material requires a specialized response. The NH Division of Public Health Services Radiological Health Section is the State's radiation control program. Their staff is trained to provide technical oversight during such responses.

Seabrook Station Nuclear Power Plant, located in Seabrook, New Hampshire is the sole nuclear power plant in New Hampshire. Seabrook Station is an 1150 megawatt pressurized water reactor (PWR), which began operation in 1990 and is licensed to operate until 2026. Vermont's only nuclear power generator, Vermont Yankee, located in Vernon, Vermont, immediately across the Connecticut River from Hinsdale, NH ceased operations on December 29, 2014. The spent fuel from both these reactors is stored onsite.

An additional facility handling nuclear materials near New Hampshire is the Portsmouth Naval Shipyard which conducts maintenance and refueling of nuclear submarines at its facilities on the Piscataqua River. Depot modernization maintenance typically requires less than a year in port, and an engineered refueling overhaul is a two year operation. The shipyard services up to four submarines at a time. All spent fuel removed from submarines is transported to the US Department of Energy's Idaho National Engineering and Environmental Laboratory.

No deaths or serious injuries have ever been attributed to a radiological incident or event in the State of New Hampshire.

Cyber Event

HIRA Risk: High
Future Probability: High
Counties at Risk: All

Definition:
The Department of Homeland Security (DHS) defines a cyber incident as an event occurring on or conducted through a computer network that actually or imminently jeopardizes the confidentiality, integrity, or availability of computers, information or communications systems or networks, physical or virtual infrastructure controlled by computers or information systems, or information resident thereon.[190]

Location:
The entire State of New Hampshire is vulnerable to a Cyber Event.

Background and evolving hazard information:
The State of New Hampshire continues to increase its reliance on computers and the Internet. With this upturn in dependence comes the escalated risk for a cyber event to occur. Potential cyber event targets include, but are not limited to: critical infrastructure; the public and private sector; and New Hampshire citizens via cyberattacks such as security breaches, spear phishing, and social media fraud.

Authorized under Executive Order 2016-06, the New Hampshire Cyber Integration Center (NH CIC) serves as the unified State center for coordinating cybersecurity monitoring, sharing information, performing cybersecurity threat analysis, and promoting shared and real-time situational awareness between and among executive branch agencies and departments.

The NH CIC is located within the Incident Planning and Operations Center (IPOC) and managed by the New Hampshire Division of Homeland Security and Emergency Management. The NH CIC integrates State employees from various agencies whose shared responsibilities include the monitoring of networks, sharing of information and situational awareness, and coordination of response, mitigation, and recovery efforts to protect against cyber-attacks and secure private personal information. Additionally, these individuals manage all known or suspected cybersecurity incidents within state agencies, or within any vendor acting as an agent of the State, and established the NH CIC Executive Oversight Committtee to oversee the operations of the NH CIC and the implementation of its strategic plan and governance.[191]

Previous occurences of cyber events in the State have impacted the public and private sector. In 2016 the Manchester, New Hampshire based Domain Name Server (DNS) product suite company, Dyn, was affected by an “unprecedented” cyber attack. The attack utilized Mirai botnet, open-source malware which is used to turn internet-enabled devices into “attack vectors for Denial of Service (DDoS) attacks”.

[190] https://www.us-cert.gov/sites/default/files/ncirp/National_Cyber_Incident_Response_Plan.pdf
[191] https://www.nh.gov/doit/cybersecurity/nh-cic/index.htm

The cyber-attack on Dyn's domain name system (DNS) infrastructure, which monitors and routes internet traffic, affected popular sites such as Twitter, Reddit and Spotify.[192]

According to the NH CIC, the following table reflects a snapshot of 2017-2018 cyber event attempts towards employees working for the public sector:

Summary	Date Submitted	Date Closed
Internet - Website for National Emergency Management Association - is it safe to click on?	1/4/2017	1/4/2017
DHHS - Unknown Bot CnC Beacon - Potential BoT	1/6/2017	1/11/2017
DHHS [Eagle Square] - Description: Ponmocup Redirection from infected Website to Trojan-Downloader	1/18/2017	1/23/2017
High Vuln SSL v2 supported external facing server	1/19/2017	1/19/2017
Sharepoint file sharing site	1/27/2017	1/30/2017
Wordpress website access	1/30/2017	2/22/2017
FW: OpenDNS for Resident Use PCs	2/16/2017	2/16/2017
DES - Blocked connection port 16003 using www.sutronwin.com port	2/17/2017	2/21/2017
DOE - IPS Alerts on DB	3/6/2017	3/8/2017
ITSG Ticket	3/27/2017	3/28/2017
Request for GAM staff for FS access	3/27/2017	3/30/2017
ITSG Ticket Request	3/28/2017	3/29/2017
ITSG Ticket Request	3/29/2017	3/29/2017
2017 PCI audit - Foundstone scans	3/29/2017	3/30/2017
2017 PCI Audit - - incident report	3/29/2017	3/30/2017
Laptop connected with malicious site	4/5/2017	4/10/2017
ITSG Ticket	4/6/2017	4/6/2017
VPN Request Form Change	4/7/2017	4/10/2017
FW: INTRUSIONS AFFECTING MULTIPLE VICTIMS ACROSS MULTIPLE SECTORS	4/28/2017	5/1/2017
FW: Web server on desktop	5/5/2017	6/6/2017
DES - MS Exchange - sent on behalf of	5/22/2017	6/12/2017
DES Email Account Compromise	5/23/2017	5/23/2017
iPad Photo Streaming	5/31/2017	5/31/2017
DHHS: Unable to Access Application	6/1/2017	6/9/2017
Wifi setup issue at DOL - Policy issue of using another's login credentials	6/1/2017	6/12/2017
Cyber issue	6/13/2017	6/19/2017
DOS: Lost Phone remote wipe	6/16/2017	6/19/2017
Gpg4win install	6/22/2017	6/23/2017
Request for exception to a security policy	6/26/2017	6/26/2017
DoIT: Cyber Incident report	6/27/2017	6/28/2017
DOT - Petya Ransomware - Action Required	6/28/2017	6/28/2017
DHHS - Potential Malware	7/5/2017	7/10/2017
Liquor - PCI Scan - MS17-010 Vulns Found	7/7/2017	8/4/2017
DHHS: Potential Router Compromise	7/10/2017	7/12/2017
JBoss Vulnerabilities on SOS Servers	7/10/2017	9/7/2017
Lottery - http://commission.nh.worldtouchgaming.com:8882/App/Client.html - Access Blocked	7/11/2017	7/18/2017

[192] http://www.unionleader.com/Dyn:-Cyberattack-was-unprecedented

Summary	Date Submitted	Date Closed
NH-CIC CYBER INCIDENT	7/17/2017	7/18/2017
Asana cloud service	7/18/2017	8/3/2017
Scan laptop for malware	7/20/2017	7/25/2017
Scan computer for possible virus	7/25/2017	9/11/2017
Scan laptop for possible virus	7/25/2017	9/11/2017
DOJ: Missing iPhone	7/31/2017	8/15/2017
Loss of Netflow traffic to Qradar from DOS core	8/16/2017	
DHHS - please report to NH CIC	8/21/2017	8/21/2017
Computer Scan for malware	8/24/2017	8/25/2017
DHHS - Malware / Password compromise	8/30/2017	8/31/2017
Would like ITSG coverage for 9/26	8/30/2017	8/31/2017
DOI - Secure Website Blocked	9/20/2017	9/21/2017
FW: NH - Multiple Albert Incidents Generated - MS-ISAC Tickets 690915, 690916	9/22/2017	10/2/2017
Email attachments--security	9/25/2017	9/26/2017
DHHS: NH-CIC CYBER INCIDENT - Contractor's Mac Plugged Into Network	10/11/2017	10/13/2017
DHHS: Change User Account Password - Irwin	10/12/2017	10/13/2017
FW: Large Volume of Alerts (Detection handled)	10/16/2017	10/18/2017
Auditor PC Scan	10/19/2017	10/20/2017
SOS - Kovter POST to CnC Server	10/31/2017	10/31/2017
NH - Message from MS-ISAC: Vulnerable System - State of New Hampshire - MS-ISAC SOC TICKET 709174	11/2/2017	11/2/2017
Spam Received Scan Needed - ITSG	11/6/2017	11/7/2017
DOS: Encrypted email assistance	11/7/2017	11/9/2017
DOE - New from NCRTM: Issue #14 -- newsletter links redirect to an Office 365 page not displayed error message	11/15/2017	11/17/2017
TSA Cyber security Message	11/27/2017	11/28/2017
DOL: Website blocked	11/29/2017	11/29/2017
SPAM - Invoice #040812 third reminder	11/30/2017	11/30/2017
DOE: iPad stolen	11/30/2017	12/21/2017
Citrix PW Reset	12/4/2017	12/7/2017
FW: NH - New - Critical Incident 731406 - Successful RBC Royal Bank Phish Nov 10 2017 - MS-ISAC SOC Ticket 731406	12/5/2017	12/5/2017
NH-CIC CYBER INCIDENT	12/5/2017	12/7/2017
One drive Request	12/7/2017	12/18/2017
DOC - System Scanner Recommendations	12/15/2017	12/18/2017
Secure Banking Commission Mobile Broadband Routers.	12/18/2017	1/23/2018
Trying to locate device @ DHHS	12/21/2017	1/3/2018
ITSG to Secure Verizon Aircards for NHBD	1/26/2018	2/13/2018
Potential HIPPA Breach	1/30/2018	2/5/2018
DHHS - NH-CIC CYBER INCIDENT - Response Ticket #121	2/2/2018	2/5/2018
FW: NH - New - Critical Incident 776637 - Successful RBC Royal Bank Phish Nov 10 2017 - MS-ISAC SOC Ticket 776637	2/6/2018	2/8/2018
Unmanaged switches on Bank Network	2/8/2018	2/8/2018
DOE: Account Access	2/14/2018	2/15/2018

New Hampshire continues to build upon its current capabilities. The Department of Homeland Security's National Cyber Incident Response Plan (NCIRP) (December 2016), declares that all states are responsible for establishing a State Cyber Incident Response Plan. This plan should identify the threats of malicious cyber activity to networks and systems, and determine the frequency and magnitude of those threats. Based on the analysis, mitigating activities should be identified and implemented. Currently the State of New Hampshire is in process of building out and exercising this document. Additionally, an annual mandate for cyber security training was implemented for all State employees.

Extent

The National Cybersecurity and Communications Integration Center (NCCIC) uses the Cyber Incident Scoring System to measure the magnitude of a cyber incident. [193] The NCCIC Cyber Incident Scoring System (NCISS) uses the following weighted arithmetic mean to arrive at a score between zero and 100:

Each category has a weight, and the response to each category has an associated score. The categories are:

- Functional Impact
- Observed Activity
- Location of Observed Activity
- Actor Characterization
- Information Impact
- Recoverability
- Cross-Sector Dependency
- Potential Impact

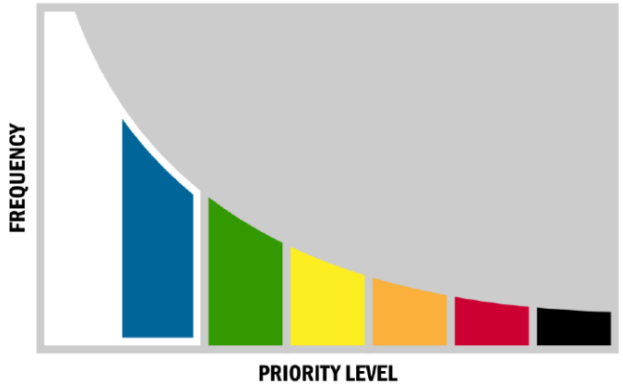
Each response score is multiplied by the category weight, and the weighted scores are summed.

Calculate the minimum possible weighted score sum and subtract this number from the previously calculated sum of the weighted scores. Divide the result by the range: the difference between the maximum possible weighted score sum and the minimum possible weighted score sum. Finally, multiply the resulting fraction by 100 to produce the final result.

Weights and values are specific to an individual organization's risk assessment process. Accompanying this document is a representative tool that demonstrates a reference implementation of the concepts outlined in this system.

Once scored, the incident is assigned a priority level.

[193] https://www.us-cert.gov/sites/default/files/publications/NCCIC_Cyber_Incident_Scoring_System.pdf



EMERGENCY (BLACK)

An Emergency priority incident poses an imminent threat to the provision of wide-scale critical infrastructure services, national government stability, or the lives of U.S. persons.

SEVERE (RED)

A Severe priority incident is likely to result in a significant impact to public health or safety, national security, economic security, foreign relations, or civil liberties.

HIGH (ORANGE)

A High priority incident is likely to result in a demonstrable impact to public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.

MEDIUM (YELLOW)

A Medium priority incident may affect public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.

LOW (GREEN)

A Low priority incident is unlikely to affect public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence.

BASELINE

A baseline priority incident is highly unlikely to affect public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence. The bulk of incidents will likely fall into the baseline priority level with many of them being routine data losses or incidents that may be immediately resolved. However, some incidents may require closer scrutiny as they may have the potential to escalate after additional research is completed. In order to differentiate between these two types of baseline incidents, and seamlessly integrate with the CISS, the NCISS separates baseline incidents into Baseline–Minor (Blue) and Baseline–Negligible (White).

BASELINE – MINOR (BLUE)

A Baseline–Minor priority incident is an incident that is highly unlikely to affect public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence. The potential for impact, however, exists and warrants additional scrutiny.

BASELINE – NEGLIGIBLE (WHITE)

A Baseline–Negligible priority incident is an incident that is highly unlikely to affect public health or safety, national security, economic security, foreign relations, civil liberties, or public confidence. The potential for impact, however, exists and warrants additional scrutiny.

Mass Casualty Incident

HIRA Risk: Low
Future Probability: Low
Counties at Risk: All

Definition:

Any large number of casualties produced in a relatively short period of time, usually as the result of a single incident such as a military aircraft accident, hurricane, flood, earthquake, or armed attack that exceeds local logistic support capabilities.[194]

Location:

The entire State of New Hampshire is vulnerable to a Mass Casualty Incident (MCI).

Background and evolving hazard information:

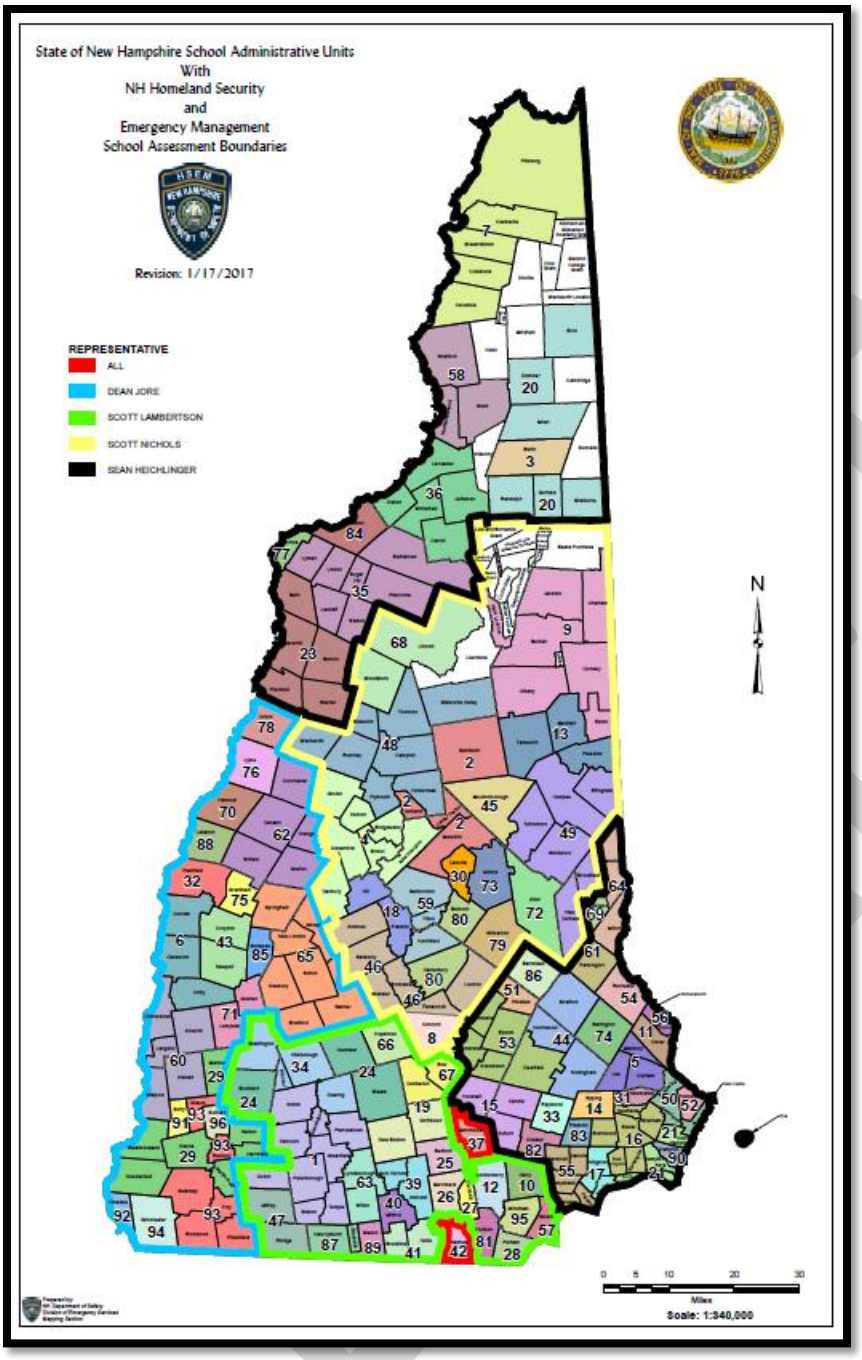
According to FEMA's Fire/Emergency Medical Services Department Operational Considerations and Guide for Active Shooter and Mass Casualty Incidents, more than 250 people have been killed in the United States during what has been classified as Active Shooter and Mass Casualty Incidents (AS/MCIs) since the Columbine High School shooting in 1999 until 2013 when the document was published. Recent high profile events that have garnared national attention have included the Inland Regional Center in San Bernardino, CA (2015)[195] and Stoneman Douglas High School in Parkland, FL (2018). These type of events may take place anywhere in the State of New Hampshire impacting fire and police departments, regardless of their size or capacity. [196]

The State has experienced its share of Mass Casualty Incidents, most recently the assumed contaminate release at Exeter Hospital in August 2017 resulting in numerous staff members becoming dizzy and nauseous. Multiple neighboring community ambulances responded and transferred employees to other area hospitals while investigators tested the air for the cause. Although a cause was never identified, parts of the hospital were closed down and cleaned in an attempt to mitigate further illness. [197]

In February 2014, firefighters from across southern New Hampshre responded to a Peterborough manufacturing company, New Hampshire Ball Bearings Inc., following an industrial explosion leaving two people critically injured and four with serious injuries. [198]

Concord High School experienced an active shooter in December 1985 when a former student entered the school with a shotgun shortly after eight in the morning. Two students were held hostage when police arrived on scene. The incident ended with the fatality of the gunman by justified police force. [199]

[194] https://apps.usfa.fema.gov/thesaurus/main/termDetail?id=1530&letter=M
[195] https://www.fbi.gov/file-repository/activeshooter_incidents_2001-2016.pdf/view
[196] https://www.usfa.fema.gov/downloads/pdf/publications/active_shooter_guide.pdf
[197] http://www.unionleader.com/public-safety/ambulances-respond-to-mass-casualty-incident-at-exeter-hospital--20170811
[198] https://patch.com/new-hampshire/nashua/major-explosion-mass-casualty-incident-at-nh-manufacturer
[199] https://www.edweek.org/ew/articles/1985/12/11/06130034.h05.html



Currently the New Hampshire Department of Safety, Division of Homeland Security and Emergency Mangement promotes and implements its School Emergency Readiness Program. This program offers a free voluntary physical security assessment of Kindergarten through grade 12 schools in New Hampshire. The assessments look at the physical buildings and grounds and make observations and recommendations based on three Physical Security Capabilities: Surveillance, Access Control, and Emergency Alerting.

It is essential that the State continues to implement and provide outreach and training to first responders in order to mitigate the occurrence of a mass casualty event and/or lessen the potential impacts.

Terrorism/Violence
HIRA Risk: High
Future Probability: Low
Counties at Risk: All

Definition:
Premeditated, politically motivated violence perpetrated against noncombatant targets by subnational groups or clandestine agents.[200]

According to the Federal Bureau of Investigation (FBI), the term terrorism can be subcategorized into two catagories:

- International Terrorism: Perpetrated by individuals and/or groups inspired by or associated with designated foreign terrorist organizations or nations (state-sponsored).
- Domestic Terrorism: Perpetrated by individuals and/or groups inspired by or associated with primarily U.S.-based movements that espouse extremist ideologies of a political, religious, social, racial, or environmental nature. [201]

Location:
The entire State of New Hampshire is vulnerable to both terrorist attacks and violent crimes.

Background and evolving hazard information:
Terrorist or terrorist support activities that may occur throughout the world and New Hampshire include, but are not limited to: communicated threats, money laundering, narco-terrorism, fraud, espionage, assassinations, kidnappings, hijackings, bomb threats and bombings, cyber attacks (computer-based), and the potential use of chemical, biological, nuclear and radiological (CBRN) weapons of mass destruction (WMDs).

High-risk targets for acts of terrorism include: military and civilian government facilities, commercial airports, large cities and high-profile landmarks, large public gatherings, water and food supplies, utilities, and corporate centers. Furthermore, terror groups have recognized the capability of spreading fear by sending explosives or chemical and biological agents through the mail.

Within the immediate area of a terrorist event, police, fire and other public officials are relied on for direction and on-scene emergency management. However, preparations for a terrorist event are made in much the same way as other crisis events wherein foundational emergency management principals are followed. Current threats and reports from international attacks also warrant continued training in an effort to identify secondary attack potentials and ensure first responders remain cognizant of the potential for continued attacks after the first occurrence of such.

Since September 11, 2001, the overriding concern has been focused on the threat of a terrorist attack carried out by international groups who are able to capitalize on perceived weaknesses in the United States. This terror threat is compounded by the threat of Homegrown Violent Extremists (HVE) as well as the threat of domestic terror groups and lone wolf offenders.

[200] Title 22 of the US Code, Section 2656f(d):
[201] https://www.fbi.gov/investigate/terrorism

An HVE is a person or group of people who are inspired by a global terrorist organization that prepares, plans, and executes their attacks without direct support or guidance from the terrorist organization. Lone wolf offenders are not directed or controlled by any specific terror group, but are often inspired by domestic terror group beliefs, grievances, and rhetoric through propaganda videos and articles.

The threat of a terror attack by HVEs or lone wolf offenders is of significant concern based on their lack of connection to a larger conspiracy, autonomy and low profile, all of which limit the ability of law enforcement to detect and disrupt such plots. Furthermore, attacks of this nature present equal risk to every state, city, town, and municipality in the U.S., as the symbolic targeting of key infrastructure and population locations is often focused around the nearest available target rather than the national visibility of that target.

The cyber threat in New Hampshire and the United States is of significant concern. Terrorists are increasingly using the cyber domain to conduct attacks and complete other activities (i.e., fund raising through fraud and phishing, spreading terrorist doctrines, organizing people and resources, etc.). With the growing dependence on computers and internet-based critical programs comes the opportunity for cyber criminals to do harm and exploit weaknesses within information technology systems.

Terrorists historically have taken advantage of civil unrest. Title 18 U.S. Code, Subsection 232 describes civil disorder as "any public disturbance involving acts of violence by assemblages of three or more persons causing immediate danger, damage, or injury to the property or person of another individual." New Hampshire is not immune to public disorder and has experienced incidents in the past at Hampton Beach, the annual Laconia Motorcycle Rally, the Seabrook Station Nuclear Power Plant and university and college campuses across the State. Civil disorder is recognized as a societal hazard in New Hampshire because of the associated potential for loss of life, injury, property damage, and economic disruption.

While New Hampshire has been fortunate to escape a major terrorist attack, it has not been immune from terrorist incidents or violent crimes. In 1972, a pipe bomb was detonated and destroyed portions of the main tower at the Manchester Airport. In 1998, a pipe bomb was partially detonated within the Concord City Library causing a fire. A short time later, a second pipe bomb was found on the steps of the New Hampshire State Library. This incident followed an anonymous letter sent to the Governor's office which indicated that bombs would be detonated within the City of Concord. Since that time, there have been numerous bomb threats throughout New Hampshire requiring the response of emergency officials.

Notable Previous Occurrences of Major Criminal Activity:

Major Criminal Incident	Location	Date
Police Chief fatality, four officers wounded during drug raid	Greenland, New Hampshire	4/12/2012
Officer fatality after responding to a domestic disturbance	Brentwood, New Hampshire	5/12/2014
Patient fatality in the ICU at Dartmouth-Hitchcock Medical Center in Lebanon	Lebanon, New Hampshire	9/12/2017

Major Criminal Incident	Location	Date
Burglary and Arson by use of Molotov Cocktail in Kingston	Kingston, New Hampshire	1/17/2018

The New Hampshire Information and Analysis Center (NH IAC) is a cooperative effort under the New Hampshire Department of Safety between the New Hampshire State Police and New Hampshire Homeland Security and Emergency Management. The NHIAC was established as an all-crimes/all-hazards, counter-terrorism information and analysis center providing strategic and tactical information directed at the most serious threats to the State of New Hampshire and its people. The center monitors information from a variety of open and classified sources, analyzes that information, and provides an information product that will serve public safety and private sector interests whose mission it is to serve the homeland security, public safety, and emergency management needs of their constituents and the State of New Hampshire. The center assists in the development and use of meaningful, real-time metrics in the effective and efficient deployment of public safety resources. [202]

The NH IAC and HSEM have adopted and continue to promote the U.S. Department of Homeland Security Secretary's "If You See Something, Say Something™" campaign. This initiative is a simple and effective program to raise public awareness of indicators of terrorism and terrorism-related crime and to emphasize the importance of reporting suspicious activity to the proper local law enforcement authorities.

Currently, the Department of Homeland Security utilizes the National Terrorism Advisory System (NTAS) to communicate information about terrorist threats by providing timely, detailed information to the American public. [203]

[202] https://www.nh.gov/safety/information-analysis-center/index.html
[203] https://www.dhs.gov/sites/default/files/publications/NTAS_v2_poster_01.pdf

Transport Accident (Aviation, Rail, Tractor Trailer, etc.)
HIRA Risk: Medium
Future Probability: High
Counties at Risk: All

Definition:
A transport accident is any accident that occurs during transportion. Specifically, for this Plan, it refers to an aviation, rail, shipping, tractor trailer, or vehicle accident.

Location:
The entire State of New Hampshire is vulnerable to a Transport Accident.

Background and evolving hazard information:
In total, 25 airports currently function throughout the State. Three are categorized as major airports including: Portsmouth International Airport at Pease (PSM), Manchester-Boston Regional Airport (MHT), and Lebanon Municipal Airport (LEB), while the remaining 22 promote regional or limited service.

Previous Ocurrences of Air Accidents:

Transport Accident	Summary	Date
Air	Alton, New Hampshire	2/11/2007
Air	Nashua, New Hampshire	4/23/2007
Air	Whitefield, New Hampshire	5/6/2007
Air	Franconia, New Hampshire	5/13/2007
Air	Nashua, New Hampshire	5/25/2007
Air	Moultonboro, New Hampshire	9/16/2007
Air	East Hampstead, New Hampshire	10/15/2007
Air	West Ossipee, New Hampshire	11/11/2007
Air	Alton, New Hampshire	12/22/2007
Air	Sunapee, New Hampshire	8/21/2008
Air	Bristol, New Hampshire	8/27/2008
Air	Sandown, New Hampshire	9/12/2008
Air	Epping, New Hampshire	10/12/2008
Air	Madison, New Hampshire	10/15/2008
Air	Bow, New Hampshire	12/22/2008
Air	Windham, New Hampshire	2/17/2009
Air	Meredith, New Hampshire	5/25/2009
Air	Gilford, New Hampshire	6/13/2009
Air	Strafford, New Hampshire	9/5/2009
Air	Alton Bay, New Hampshire	2/14/2010
Air	Hanover, New Hampshire	9/1/2010
Air	Franconia, New Hampshire	9/25/2010
Air	Rochester, New Hampshire	12/11/2010
Air	Moultonboro, New Hampshire	5/1/2011
Air	Concord, New Hampshire	5/31/2011
Air	Greenland, New Hampshire	7/6/2011
Air	Whitefield, New Hampshire	11/5/2011

Transport Accident	Summary	Date
Air	Nashua, New Hampshire	11/9/2011
Air	Lebanon, New Hampshire	2/9/2012
Air	West Ossipee, New Hampshire	5/13/2012
Air	Hampton, New Hampshire	10/24/2012
Air	Hooksett, New Hampshire	10/25/2012
Air	Concord, New Hampshire	5/31/2013
Air	Concord, New Hampshire	6/5/2013
Air	Tuftonboro, New Hampshire	7/17/2013
Air	Portsmouth, New Hampshire	8/2/2013
Air	Rumney, New Hampshire	8/30/2013
Air	Newport, New Hampshire	10/14/2013
Air	Colebrook, New Hampshire	4/10/2014
Air	Concord, New Hampshire	4/20/2014
Air	Gilford, New Hampshire	4/22/2014
Air	North Hampton, New Hampshire	9/1/2014
Air	Brookline, New Hampshire	12/5/2014
Air	Henniker, New Hampshire	12/22/2014
Air	Nashua, New Hampshire	1/23/2015
Air	Hampton, New Hampshire	6/14/2015
Air	Laconia, New Hampshire	6/18/2015
Air	Concord, New Hampshire	6/20/2015
Air	Laconia, New Hampshire	9/5/2015
Air	Jackson, New Hampshire	10/14/2015
Air	Keene, New Hampshire	4/30/2016
Air	Keene, New Hampshire	5/11/2016
Air	Warner, New Hampshire	5/29/2016
Air	Gorham, New Hampshire	6/16/2016
Air	New Durham, New Hampshire	7/6/2016
Air	Keene, New Hampshire	7/7/2016
Air	Northwood, New Hampshire	8/6/2016
Air	North Conway, New Hampshire	8/15/2016
Air	Andover, New Hampshire	9/27/2016
Air	Concord, New Hampshire	10/03/2016
Air	Portsmouth, New Hampshire	10/4/2016
Air	Concord, New Hampshire	11/10/2016
Air	North Hampton, New Hampshire	12/4/2016
Air	Nashua, New Hampshire	7/4/2017
Air	Berlin, New Hampshire	7/5/2017
Air	Winchester, New Hampshire	7/13/2017
Air	Newport, New Hampshire	8/20/2017
Air	Berlin, New Hampshire	10/29/2017
Air	Haverhill, New Hampshire	3/26/2018

There are 459 miles of active railroad in New Hampshire. The State is the largest railroad owner with over 200 miles of active line, purchased to preserve freight service to industry or promote tourism and economic development. Nine freight railroads operate in the State, and freight volumes have increased over the past several years.[204]

Previous Occurences of Rail Accidents:

Transport Accident	Summary	Date
Rail	Derailment, Nashua	3/3/13
Rail	Vehicular Collision, Rochester	12/18/13
Rail	Derailment, Nashua	2/18/14
Rail	Human Collision, Concord	7/4/14
Rail	Human Collision, Durham	9/24/14
Rail	Vehicular Collision, Charlestown	9/25/14
Rail	Vehicular Collision, Dover	12/5/14
Rail	Vehicular Collision, Wakefield	8/7/15
Rail	Vehicular Collision, North Conway	7/22/16
Rail	Human Collision, Rochester	9/12/16
Rail	Vehicular Collision, Madbury	10/18/16
Rail	Human Collision, Claremont	11/4/16
Rail	Vehicular Collision, East Kingston	11/18/17

Recreational and commercial boat travel occurs along New Hampshire Coastline and harbors as well as throughout the State's numerous lakes and rivers. The Division of Ports and Harbors (DPH) assists in the establishment of accommodations for the boat traveler, the area boat owner, the pleasure fishermen and others who pass up and down the New Hampshire coastline or in its tributaries, particularly the Piscataqua River and Portsmouth Harbor.[205] According to the New Hampshire Coast Guard there have been a total of 22 shipping incidents in New Hampshire waters since 2008. These incidents were comprised of 7 allisions, 4 collisions, and 11 groundings.

Of the roads in the State, 225 miles (362 km) are Interstate highways (35 miles (56 km) of which are also on the New Hampshire Turnpike System); 52 miles (84 km) are non-interstate turnpike highways; and 505 miles (813 km) are non-interstate and non-turnpike highways.

Based upon current transportation capabilities the State remains vulnerable to a potential transport accident. According to the New Hampshire Information and Analysis Center over the past twenty years New Hampshire has experienced an annual average of 117 fatal crashes (127 victims) due to vehicular transportation accidents.

The Transportation Management Center (TMC) currently communicates potential hazardous road conditions, accidents, and/or road work information on electronic signage throughout the State's highway network. This capability helps promote awareness of potential variables that may cause a transportation accident on the roadway.

[204] https://www.nh.gov/dot/org/aerorailtransit/railandtransit/rail.htm
[205] http://portofnh.org/who.html

Statewide Risk Assessment

The HSEM SHMP Internal Working group met to discuss the statewide risk assessment and assign rating scores. Consideration was given to climate change, current capabilities, State assets and critical infrastructure and their locations, population data, and previous/historical occurrences when determining the scale of impacts and overall risk (probability of occurrence). Subject matter experts were consulted to ensure accuracy of these ratings.

Method for Rating Impacts, Probability of Occurrence, and Overall Risk

Impacts

The impact is an estimate generally based on a hazard's effects on humans, property, and businesses. The HSEM SHMP Internal Working Group came together and determined the impact rating for each of the previously identified hazards. If a hazard was identified as a threat to the entire State, the impact rating was determined with the entire State in mind. The average impact score was calculated by computing the average of the human, property, and business impact scores. The impact ratings were broken into the following categories:

- 1 – Inconvenience to the population, reduced service/productivity of businesses, minor damages to property, and non-life-threatening injuries to people
- 3 – Moderate to major damages to property, temporary closure and reduced service/productivity of businesses, and numerous injuries and deaths
- 6 – Devastation to property, significant injuries and deaths, permanent closure and/or relocation of services and businesses, and long-term effects on the population

Probability of Occurrence

The probability of occurrence is a numeric value that represents the likelihood that the given hazard will occur within the next 10 years. This value was chosen based on historical information provided by subject matter experts in the HIRA. The HSEM SHMP Internal Working Group came together and determined the probability of occurrence rating for each of the previously identified hazards. The probability of occurrence ratings were broken into the following categories:

- 1- 0-33% Probability of the hazard occurring within 10 years (Low)
- 2- 34-66% Probability of the hazard occurring within 10 years (Medium)
- 3- 67%-100% Probability of the hazard occurring within 10 years (High)

Overall Risk

The overall risk is a representation of the combined potential impact and probability of occurrence ratings. This is calculated by multiplying the probability of occurrence rating score by the impact rating score (the average of the human, property, and business impacts). The goal of identifying the overall risk of each identified hazard is to assist the State in determining which hazards pose the largest potential threat to the State. This will allow the SHMPC to use the overall risk ratings to develop targeted mitigation actions that allocate funding and resources to the highest rated hazards first. The overall risk ratings are broken down and color coded into the following categories:

- **Yellow:** Values 1-6 – The hazard poses a low risk to the most vulnerable counties identified
- **Orange:** Values 7-12 – The hazard poses a medium risk to the most vulnerable counties identified
- **Red:** Values 13-18 – The hazard poses a high risk to the most vulnerable counties identified

Statewide Risk Assessment – Rating Table

Threat/Hazard	Classification	Human Impact	Property Impact	Economic/ Business Impact	Average Impact Score	Probability of Occurrence	Overall Risk	Counties Most Vulnerable
Avalanches	Natural	1	1	1	1	2	**2**	Coos, Grafton, and Carroll
Coastal Flooding	Natural	3	6	6	5	3	**15**	Rockingham and Strafford
Inland Flooding	Natural	6	6	6	6	3	**18**	Statewide
Drought	Natural	1	3	3	2	2	**4**	Statewide
Earthquakes (>4.0)	Natural	1	3	1	2	1	**2**	Statewide
Extreme Temperatures	Natural	3	1	1	2	3	**6**	Statewide
High Wind Events	Natural	3	6	3	5	3	**15**	Statewide
Infectious Diseases	Natural	3	1	3	2	2	**4**	Statewide
Landslide	Natural	1	3	3	2	3	**5**	Statewide
Lightning	Natural	1	3	1	2	3	**6**	Statewide
Severe Winter Weather	Natural	6	6	6	6	3	**18**	Statewide
Solar Storms & Space Weather	Natural	3	1	3	2	1	**2**	Statewide
Tropical & Post-Tropical Cyclone	Natural	6	6	6	6	2	**12**	Statewide
Wildfire	Natural	1	1	1	1	2	**2**	Statewide
Aging Infrastructure	Technological	3	6	3	4	3	**12**	Statewide
Conflagration	Technological	6	6	6	6	2	**12**	Statewide
Dam Failure	Technological	3	3	3	3	2	**6**	Statewide
Known and Emerging Contaminants	Technological	6	6	3	5	3	**15**	Statewide
Hazardous Materials	Technological	1	3	3	2	3	**6**	Statewide
Long-Term Utility Outage	Technological	6	6	6	6	1	**6**	Statewide
Radiological	Technological	1	1	3	2	1	**2**	Statewide
Cyber Event	Human-caused	3	1	6	3	3	**9**	Statewide
Mass Casualty Incident	Human-caused	6	1	3	3	1	**3**	Statewide
Terrorism/Violence	Human-caused	6	3	3	3	3	**9**	Statewide
Transport Accident	Human-caused	3	3	3	3	3	**9**	Statewide

Impact Scoring

- 1 – Inconvenience, reduced service/productivity, minor damages, non-life-threatening injuries
- 3 – Moderate to major damages, temporary closure and reduced service/productivity, numerous injuries and deaths
- 6 – Devastation and significant injuries and deaths, permanent closure and/or relocation of services, long-term effects

Probability Scoring

- 1- 0-33% Probability of occurring within 10 years (Low)
- 2- 34-66% Probability of occurring within 10 years (Medium)
- 3- 67%-100% Probability of occurring within 10 years (High)

Potential Impacts of Natural, Technological, and Human-caused Hazards

Following the identification of natural, human-caused, and technological hazards, the summary of State assets provided in the 2013 Plan Update by county was reviewed and updated to reflect the current monetary replacement values in the event of a total loss. The critical infrastructure and key resources (CIKR) specifics are not included in this Plan pursuant to provisions of New Hampshire RSA 91-A.

Depicted below, the Department of Administrative Services (DAS) provided a list of state-owned buildings with scheduled replacement values that are currently covered under a catastrophic insurance policy. Also, the list is limited to state-owned buildings that meet replacement value thresholds either individually or, based on proximity to other locations, collectively.

Belknap County	State Agency	Building Value
	Administrative Services	$22,061,086.00
	Courts	$5,093,760
	Department of Safety	$9,964,313
	Veterans Home	$31,896,813
	Total	**$69,015,972**

Carroll County	State Agency	Building Value
	Courts	$11,032,000
	Department of Transportation	$4,874,721
	Total	**$15,906,721**

Cheshire County	State Agency	Building Value
	Adjutant General	$5,034,560
	Department of Transportation	$1,697,812
	Liquor Commission	$5,566,622
	Total	**$12,298,994**

Coos County	State Agency	Building Value
	Adjutant General	$8,663,361
	Courts	$9,408,000
	Department of Corrections	$52,055,876
	Department of Natural and Cultural Resources	$7,176,879
	Total	**$77,304,116**

	State Agency	Building Value
Grafton County	Adjutant General	$14,020,254
	Courts	$7,084,000
	Department of Health and Human Services	$17,249,694
	Department of Natural and Cultural Resources	$9,112,370
	Department of Transportation	$2,006,715
	Liquor Commission	$750,000
	Total	**$50,223,033**

	State Agency	Building Value
Hillsborough County	Adjutant General	$46,933,184
	Courts	$69,869,560
	Department of Corrections	$5,724,200
	Department of Health and Human Services	$44,297,090
	Department of Natural and Cultural Resources	$2,036,736
	Department of Safety	$1,128,138
	Department of Transportation	$8,560,007
	Liquor Commission	$2,295,000
	Total	**$178,548,915**

	State Agency	Building Value
Merrimack County	Adjutant General	$122,989,440
	Administrative Services	$261,485,722
	Courts	$7,747,040
	Department of Corrections	$144,699,159
	Department of Health and Human Services	$135,193,279
	Department of Natural and Cultural Resources	$2,322,007
	Department of Safety	$28,275,663
	Department of Transportation	$33,302,564
	Fish and Game	$7,374,887
	Liquor Commission	$22,000,000
	Police Standards & Training	$14,420,000
	Total	**$779,809,761**

Rockingham County	State Agency	Building Value
	Adjutant General	$11,596,796
	Courts	$36,476,480
	Department of Natural and Cultural Resources	$10,234,095
	Department of Safety	$600,288
	Department of Transportation	$9,732,938
	Fish and Game	$1,963,122
	Liquor Commission	$8,195,788
	Port Authority	$3,976,704
	Total	**$82,776,211**

Strafford County	State Agency	Building Value
	Adjutant General	$27,458,941
	Courts	$8,710,520
	Department of Transportation	$9,144,626
	Fish and Game	$714,738
	Total	**$46,028,825**

Sullivan County	State Agency	Building Value
	Department of Transportation	$ 2,005,000
	Total	**$2,005,000**

Current lists of non-State owned essential facilities for individual communities can be found within the Local Hazard Mitigation Plans, which are also updated on a five year cycle. Each community identifies vulnerability of such assets in comparison to the identified hazards within their plan.

Based upon the previously identified locations at which each hazard type could occur, it can be assumed that the entire State is vulnerable to the following hazards: inland flooding, drought, earthquakes, extreme temperatures, high wind events, infectious diseases, landslides, lightning, severe winter weather, solar storms and space weather, tropical and post-tropical cyclones, wildfire, aging infrastructure, conflagration, dam failure, emerging contaminates, hazardous materials, long term utility outage, radiological, cyber event, mass casualty incident, terrorism/violence, and transport accident. The occurrence of an avalanche is exclusive to Carroll, Coos, and Grafton Counties while coastal flooding is exclusive to Rockingham and Strafford Counties. If the State were to experience a total loss of all the State owned property listed above, the cumulative amount would be approximately $1,313,917,547.

After considering the potential impacts from climate change, specifically sea-level rise and extreme precipitation events, coupled with a growing population and increased tourism within that area, it was agreed that Rockingham County remains the most vulnerable. Although Rockingham County remains the most vulnerable, Merrimack County has the highest potential loss value given the figures above.

It was discussed by the SHMPC that New Hampshire needs to expand upon current descriptors use for State asset inventories. This capability gap was added as a new mitigation action for the 2018 Plan.

Climate Change in New Hampshire

Climate is defined as the long-term, prevailing pattern of temperature, precipitation, and other weather variables at a given location as described by statistics, such as means and extremes.[206] Climate differs from weather in that weather is the current state or short term variation of these variables at a given location. Climate change is the observed change in atmospheric variables over time that are the result of natural and anthropogenic, or human-caused, influences. Climate change is directly related to the ongoing increase in global temperature, a rise that is influenced by the steady increase in the concentration of atmospheric greenhouse gases (GHG) that has been occurring and continues to occur across the globe.

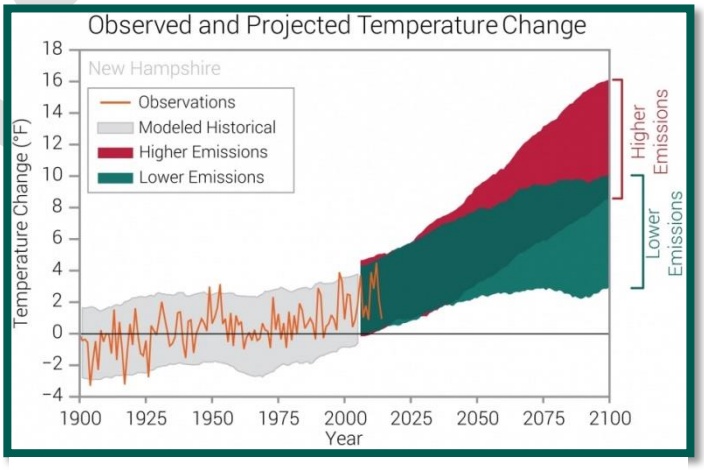
FEMA stated in the 2017 *Incorporating Climate Change into State Hazard Mitigation Planning, Region I Phase I Report* that "The scientific evidence is clear: The Earth's climate is warming. It is also very clear that the effects of climate change pose real and significant threats to community safety, resilience, and quality of life. Determining how climate change and, more specifically, future temperature and precipitation trends will affect the probability, frequency, and nature of various natural hazards is a critical step toward effective resiliency planning and hazard risk reduction across the United States."

All of New Hampshire is susceptible to the effects of climate change and has already begun to experience impacts including, but not limited to, an increased frequency of coastal flooding, inland flooding events caused by extreme precipitation, and increased average annual temperature. This chapter of the Plan highlights the natural hazards from the HIRA that are most likely to increase in severity and frequency due to climate change and discusses how climate change may exacerbate the impacts of these hazards.

Estimating Risk for Natural Hazards Affected by Climate Change

The National Oceanic and Atmospheric Administration (NOAA), in partnership with the North Carolina Institute for Climate Studies (NCICS), have produced state climate summaries detailing changes and projections in temperature, precipitation, and sea-level rise. The key messages for the State of New Hampshire included the following[207]:

- The average annual temperature has increased approximately 3°F in New Hampshire since the early 20th century. Winter warming has been larger than any other season. Future winter warming will have large effects on snowfall and snow cover.
- Precipitation has increased during the last century, with the highest numbers of extreme precipitation events occurring over the last decade. Mean precipitation and precipitation extremes are projected to increase in the future, with associated increases in flooding.



Observed and projection changes in near-surface temperature for New Hampshire. *(Photo courtesy of NOAA)*

- Global sea level has risen about 8 inches since reliable record keeping began in 1880. Sea level is projected to increase another 1 to 4 feet by 2100. Rising sea levels pose significant risks to coastal

[206] http://www.noaa.gov/resource-collections/climate-education-resources
[207] https://statesummaries.ncics.org/nh

communities and structures, such as inundation, land loss due to erosion, and greater flood vulnerability due to higher storm surge.

Extreme Precipitation and Flooding

Inland Flooding

Recent studies have shown that the intensity and frequency of extreme precipitation events in the Northeast United States have increased rapidly in recent decades. In a study by Walsh et al. (2014)[208], the northeast region of the United States was shown to have the largest increase in top 1% precipitation events, where the top 1% represents the most extreme precipitation events with the largest amounts of measureable precipitation. Additionally, in a more recent study by Howarth, M., L. Bosart, and C. Thorncroft in 2018 *(Changes in Extreme Precipitation in the Northeast United States: 1979–2014)* through The State University of New York in Albany, the following results were found regarding extreme precipitation events in the Northeast region of the United States:

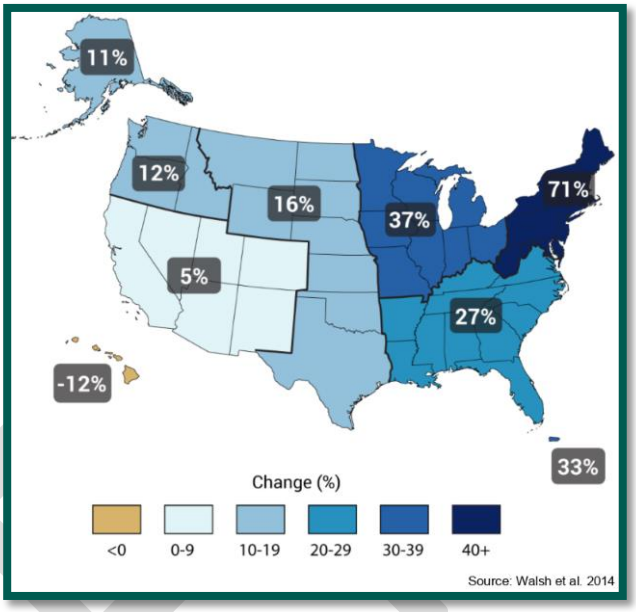


Image depicting the increase in the top 1% of precipitation events in the U.S. from 1958-2012. *(Source: Walsh et al. 2014)*

- The goal of the study was to identify trends in extreme precipitation events, where extreme precipitation was defined as the top 1% of accumulation on days with measureable precipitation.
- The top 1% threshold for extreme events increased by 9 mm from 1979-2014, based on a 5-year running average. This indicates that that magnitude and frequency of these extreme events increased over time (based on the overall trend).
- All seasons experienced an increase in total precipitation amount during these extreme, top 1% events, but Fall months showed the largest increase (17.6 mm overall, an average increase of 0.5 mm per year).
- The study showed an overall increase in the number of extreme precipitation events during the second half of the study period. The most extreme events, 150 mm (5.9 inches) or more of precipitation, have increased by 317% (19 more extreme events) between 1997-2014. Furthermore, the most significant increase in the frequency of these extreme events was seen in the summer and fall months.

[208] https://www.chijournal.org/C408

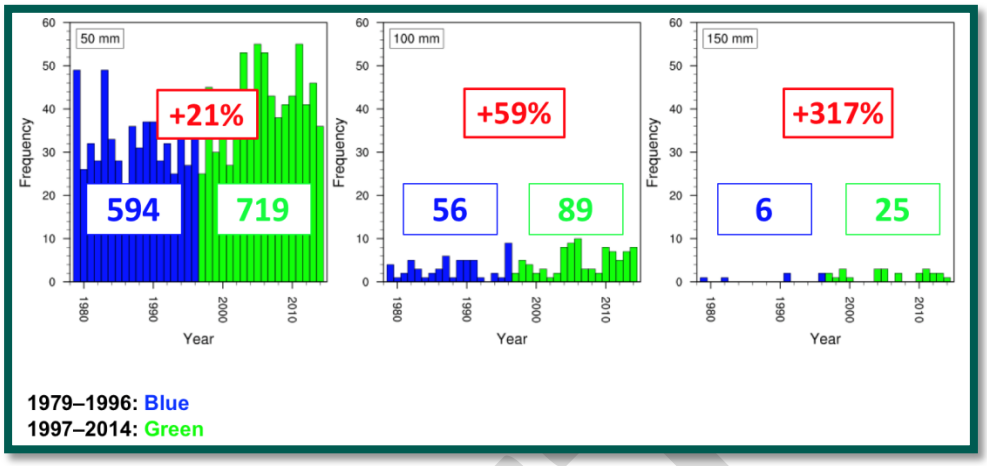
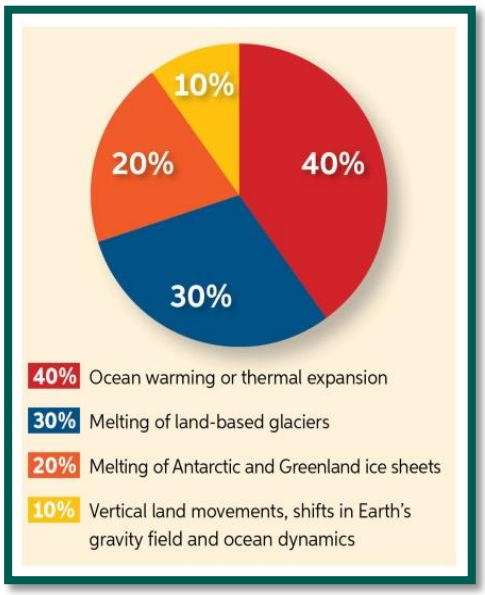


Image depicting the increase in frequency of extreme precipitation events in the northeastern U.S. from 1979-2014, where the top 1% of precipitation events is on the right with events measuring 150 mm (5.9 inches) or more. *(Source: Howarth et al. 2018)*

Furthermore, the NOAA state climate summary found that New Hampshire experienced its largest number of extreme precipitation events (defined in their report as days with more than 2 inches) between 2005-2009 (about 2.4 events per year). An above average number of extreme precipitation events were recorded between 2010-2014 as well (two events per year). This increase in extreme precipitation has coincided with a rising number of flooding events in the State, many of which have resulted in Presidential Disaster Declarations. Flooding events account for nearly half of all Presidential Disaster Declarations in the State of New Hampshire. These events have taxed State resources and strained aging and undersized infrastructure. Assuming a continuation of this trend, it is expected that extreme precipitation events will become more frequent, further exacerbating the immediate need to increase mitigation efforts.

Coastal Flooding

Coastal flooding has rapidly become a major focus of mitigation efforts as the State sees a rise in chronic coastal inundation. Coastal storms, tropical and post-tropical cyclones, and nuisance flooding from high tide events have been identified as causes for repetitive coastal flooding. Superstorm Sandy in 2012 was a hurricane which underwent an extra-tropical transition and brought destructive storm surge heights reaching 3.2 feet above normal tide to the New Hampshire coast, which cost the State an estimated $80 million dollars in total property losses from the storm. Sandy is just one example of economic loss the State has suffered due to coastal flooding.

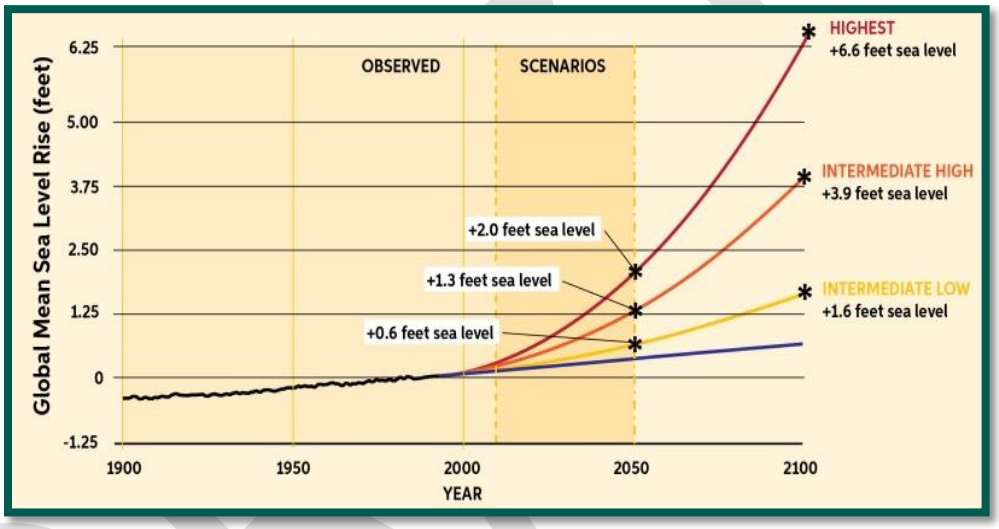


Processes causing sea levels to rise from 1990-2012. *(Source: NHCRHC)*

Coastal flooding events caused by low pressure systems and nuisance high tide flooding are anticipated to increase in both frequency and intensity with sea-level rise. Global mean sea levels rose 0.7 inches per decade between 1900 and 1993. In 1993, the sea-level rise rate increased to 1.3 inches per decade. Sea levels are expected to continue rising at an accelerating rate well beyond the end of the 21st century due to natural and human-driven changes to the global climate and local landscape. The causes and best available projections for

sea-level rise in New Hampshire have been found to be ocean warming, melting of land-based glaciers, melting of ice sheets, and vertical land movements.[209] In 2014, the New Hampshire Coastal Risk and Hazards Commission (NHCRHC) Science and Technical Advisory Panel (STAP) published a summary of best available science on storm surge, sea-level rise, and extreme precipitation projections.[210] The report states that, using 1992 as a baseline, coastal New Hampshire's sea levels would rise between 0.6 and 2.0 feet by 2050 and between 1.6 and 6.6 feet by 2100.

In addition to coastal flooding, groundwater rise has become a concern. In coastal areas, groundwater flows from recharge areas to discharge areas along the shoreline. As sea-level rises, the groundwater levels near the coast also rise until a new equilibrium is established between aquifer recharge and groundwater discharge to the sea. Modeling shows that groundwater rise driven by sea-level rise may cause flooding in areas where groundwater levels are already high, not only along the coast but also at significant distances inland.[211]



Sea-level rise scenarios under different emissions levels in 2050 and 2100.
(Source: NHCRHC)

[209] NHCRHC. 2016. http://www.nhcrhc.org/final-report/
[210] STAP. 2014. http://www.nhcrhc.org/stap-report/
[211] Knott et al. 2016. Assessing the Effects of Rising Groundwater from Sea-level Rise on the Service Life of Pavements in Coastal Road Infrastructure. Transportation Research Board. http://docs.trb.org/prp/17-05250.pdf

Mapping has been completed to understand potential flood risk to coastal municipalities from different sea-level rise scenarios and storm surge. These maps are available publicly on the New Hampshire Coastal Viewer as well as in vulnerability assessment reports for the Atlantic Coast and Great Bay regions.[212, 213, 214] Example maps below depict areas susceptible to flooding from various sea-level rise and sea-level rise concurrent with present 0.1% annual-chance storm surge for the Hampton-Seabrook estuary.

Illustration of the extent of flooding from three sea-level rise scenarios in the Hampton-Seabrook estuary. *(Source: RPC, 2015)*

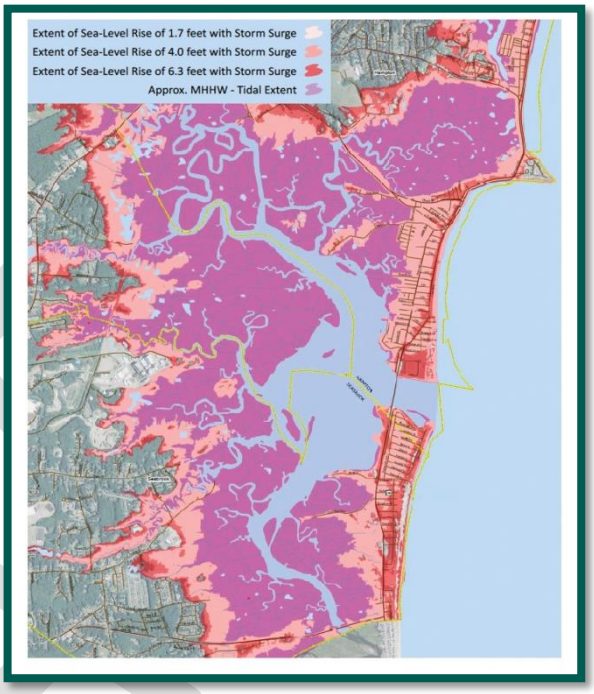
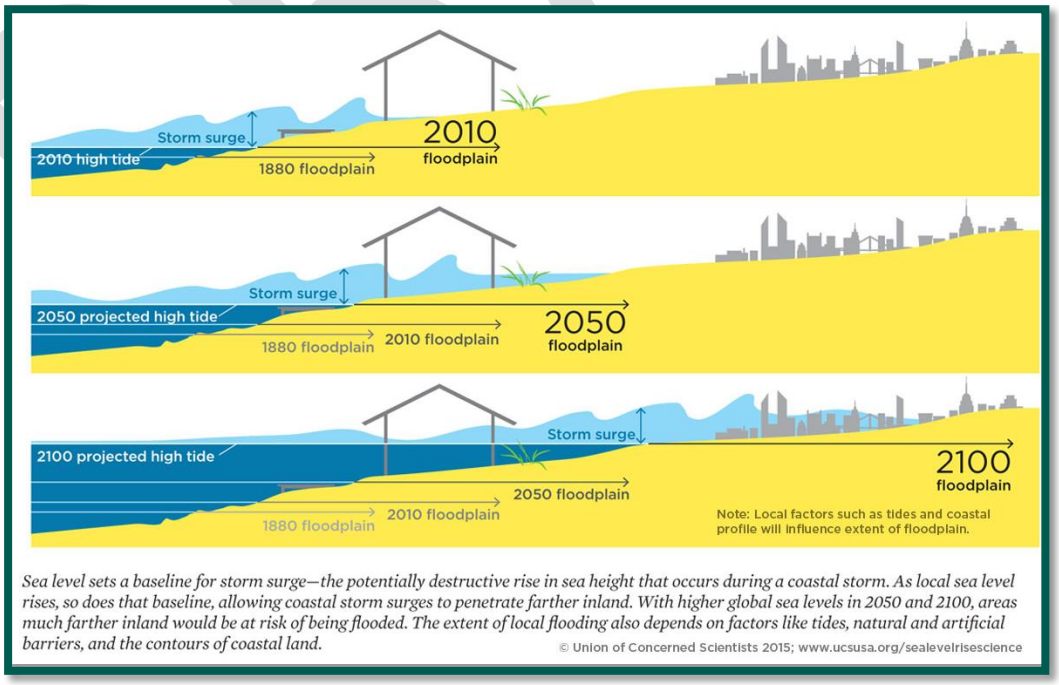


Illustration of the extent of flooding from three sea-level rise scenarios with a 100-year (1% annual chance) storm surge in the Hampton-Seabrook estuary. *(Source: RPC, 2015)*

[212] New Hampshire Coastal Viewer. www.nhcoastalviewer.org
[213] http://www.rpc-nh.org/regional-community-planning/climate-change/tides-storms
[214] https://www.des.nh.gov/organization/divisions/water/wmb/coastal/c-rise.htm

As our understanding of potential sea-level rise has improved and coastal development has intensified, it is recognized that the probability of coastal flooding is increasing. Since the release of the 2014 STAP Report, national sea-level rise scenarios have improved to include confidence interval information. Relevant key findings from the 2017 Climate Science Special Report produced for the Fourth National Climate Assessment (NSA4) are outlined below:

- Relative to the year 2000, Global Mean Sea Level (GMSL) is very likely to rise by 0.3–0.6 feet (9–18 cm) by 2030, 0.5–1.2 feet (15–38 cm) by 2050, and 1.0–4.3 feet (30–130 cm) by 2100 (very high confidence in lower bounds; medium confidence in upper bounds for 2030 and 2050; low confidence in upper bounds for 2100). Future pathways have little effect on projected GMSL rise in the first half of the century, but significantly affect projections for the second half of the century (high confidence). Emerging science regarding Antarctic ice sheet stability suggests that, for high emission scenarios, a GMSL rise exceeding 8 feet (2.4 m) by 2100 is physically possible, although the probability of such an extreme outcome cannot currently be assessed. Regardless of pathway, it is extremely likely that GMSL rise will continue beyond 2100 (high confidence).
- As sea levels have risen, the number of tidal floods each year that cause minor impacts (also called "nuisance floods") have increased 5- to 10-fold since the 1960s in several U.S. coastal cities (very high confidence). Rates of increase are accelerating in over 25 Atlantic and Gulf Coast cities (very high confidence). Tidal flooding will continue increasing in depth, frequency, and extent this century (very high confidence).
- If storm characteristics do not change, sea level rise will increase the frequency and extent of extreme flooding associated with coastal storms, such as hurricanes and Nor'easters (very high confidence). A projected increase in the intensity of hurricanes in the North Atlantic (medium confidence) could increase the probability of extreme flooding along most of the U.S. Atlantic and Gulf Coast states beyond what would be projected based solely on RSL rise. However, there is low confidence in the projected increase in frequency of intense Atlantic hurricanes, and the associated flood risk amplification and flood effects could be offset or amplified by such factors as changes in overall storm frequency or tracks.



Potential changes to the floodplain extent based on sea-level rise. *(Source: Union of Concerned Scientists)*

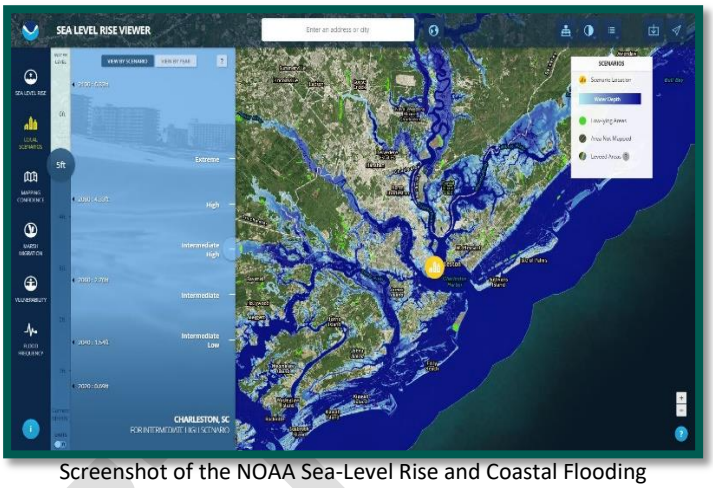
Coastal hazards associated with coastal storms, surge, sea-level rise, and extreme precipitation events can be devastating to human health and safety, public and private structures and facilities, natural resources, and the economies of coastal communities. Coastal New Hampshire was fortunate to experience minimal damage from Tropical Storm Irene in 2011 and Superstorm Sandy in 2012, compared to other states. Nevertheless, the impacts of these storms on neighboring states and the more extreme local impacts from storms such as the Mother's Day storm of 2006, the Patriots' Day storm of 2007, and other historical events have reinforced our knowledge that strong storm systems are capable of causing immense damage in areas on or near the coast. New Hampshire's coastal exposure to current and future flood risks is significant. As of 2016, the state's 17 coastal municipalities are home to approximately 11 percent of the state population, host over 100,000 jobs, and generated a 2014 Gross Regional Product of approximately $11 billion.

Several regional and local vulnerability assessments have been completed that enable a better understanding of New Hampshire assets at risk of impacts from coastal flooding. Three key regional vulnerability assessments for coastal flood risks are listed in the table below and their findings are summarized in this section. Local vulnerability assessments have been completed at fine-scale resolution for several municipalities, but they are not highlighted here.

Selection of Vulnerability Assessments Conducted in Coastal New Hampshire

Vulnerability Assessment	Date of Publication	Author Organization	Focus Area/Topic	Web Link
Preparing New Hampshire for Projected Storm Surge, Sea-Level Rise, and Extreme Precipitation	November 2016	New Hampshire Coastal Risk and Hazards Commission	Identifies flood risks associated with extreme precipitation, storm surge, and sea-level rise; focused on New Hampshire's 17 coastal communities and risks to our economy, our built landscape, our natural resources, and our heritage	www.nhcrhc.org
C-RiSe: Climate Risk in the Seacoast	March 2017	Rockingham Planning Commission and Strafford Regional Planning Commission	Maps and quantifies flood risks associated with storm surge, and sea-level rise; focused on New Hampshire's 10 tidally-influenced Great Bay communities and risks to specific assets, including critical facilities, assessed tax value of impacted properties, historic properties, and conservation land.	https://www.des.nh.gov/organization/divisions/water/wmb/coastal/c-rise.htm
From Tides to Storms: Preparing for New Hampshire's Future Coast	September 2015	Rockingham Planning Commission	Maps and quantifies flood risks associated with storm surge, and sea-level rise; focused on New Hampshire's 7 Atlantic Coast communities and risks to specific assets, including critical facilities, assessed tax value of impacted properties, historic properties, and conservation land.	http://www.rpc-nh.org/regional-community-planning/climate-change/tides-storms
Sea level affecting marshes model for New Hampshire	August 2014	New Hampshire Fish and Game Department	Maps and quantifies potential changes to wetland types as a result of sea-level rise, with an emphasis on how salt marshes will migrate or disappear under different sea-level rise scenarios.	http://www.granit.unh.edu/data/search?sterm3=slamm&fieldname3=themekey

As the previous Plan indicated, NOAA was creating a Sea-Level Rise and Coastal Flooding Impacts Viewer to help visualize the potential impacts from sea-level rise. That tool is now available online through NOAA's Office for Coastal Management website.[215] This tool allows users to visualize community level impacts from coastal flooding or sea-level rise (up to 6 feet above average high tides). This tool also provides simulations of how future flooding might impact local landmarks as well as data related to water depth, connectivity, flood frequency, socio-economic vulnerability, wetland loss and migration, as well as mapping confidence. This tool was updated twice in 2015, twice in 2016, and most recently in April 2017.



Screenshot of the NOAA Sea-Level Rise and Coastal Flooding Impacts Viewer. *(Source: NOAA)*

Vulnerabilities to Coastal Flooding

Built Landscape

State and local roadways and associated infrastructure throughout the coastal region are vulnerable to flooding and damage due to storm surge, sea-level rise and extreme precipitation. In many municipalities, flooding is magnified by the combination of tidal or storm-related flooding and freshwater flooding. The Tides to Storms vulnerability assessment conducted for the seven Atlantic Coast communities reported that, under an intermediate sea-level rise scenario of 4.0 feet, 90 public infrastructure sites, and nearly 24 miles of state and local roads could be subject to daily tidal flooding by 2100. Under the same 4.0 feet sea-level rise scenario, the C-RiSe vulnerability assessment conducted for the ten Great Bay municipalities reported that 23 public infrastructure sites, and only one mile of state and local roads could be subject to daily tidal flooding by 2100.

Natural Resources

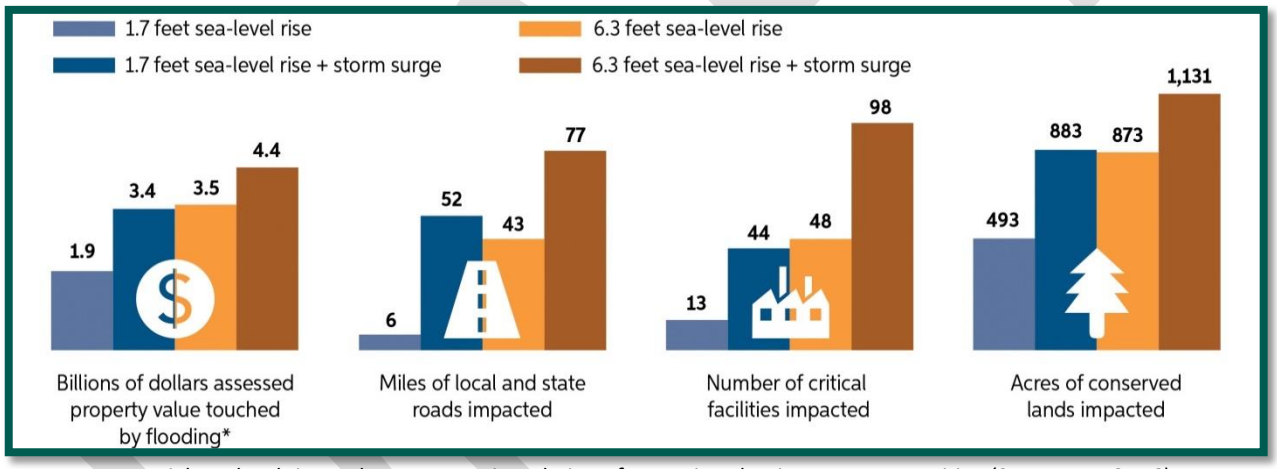
The natural resources that draw residents, visitors, and businesses to southeastern New Hampshire are a cornerstone of our quality of life. As reported in the 2015 Wildlife Action Plan, sea-level rise will alter the function of coastal habitats such as salt marshes and estuaries, habitat availability, and the timing of nesting and migration for seabirds. Total habitat and species losses will likely be greater in developed areas where there is no space for natural habitats to retreat or migrate inland. Modeling results suggest that salt marshes will likely reach a tipping-point under a 6.6 foot sea-level rise scenario, with 95 percent of salt marshes potentially disappearing by 2100. Coastal storm surges disrupt dunes, salt marshes, and estuaries. These habitat types are critical to rare species like the saltmarsh sparrow and the piping plover. The sudden changes in salinity, water level, and sedimentation that storm surge causes can be devastating to coastal plants and animals and the habitat types that they depend on. Dunes protect structures and facilities as well as the habitat that lies behind them, and major storm surges would naturally push dunes "back." When dunes do not have a natural path to retreat, they disappear and/or erode. High tides and storm surges will move dunes and may lead to barrier beaches being breached by large storm events. A major breach would change the salt marsh habitat behind the dunes, as well as the beach itself, and sedimentation from large storm events could also smother eelgrass and shellfish beds.

[215] https://coast.noaa.gov/digitalcoast/tools/slr

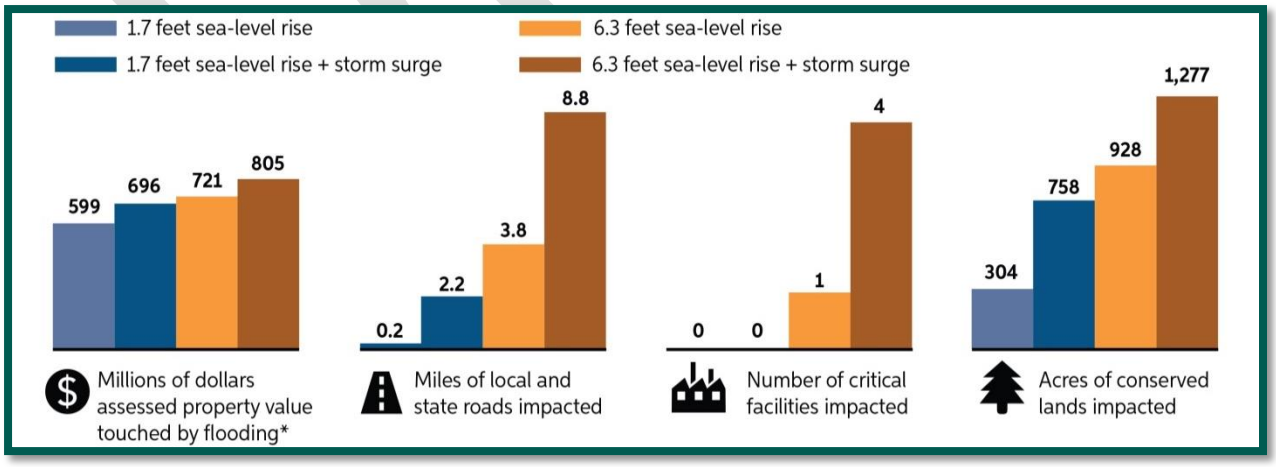
Critical Facilities

Communities and state agencies recognize the importance of ensuring that emergency facilities and shelters are located in places that are secure and accessible, and that the energy facilities and communications systems that our critical facilities rely on are well-protected. A preliminary assessment of some critical facilities shows a few examples at risk of sea-level rise and storm surge. Under a sea-level rise scenario of 4.0 feet, 33 critical facilities would be vulnerable to inundation during the diurnal high tide in the Atlantic Coast. If a one-percent-annual-chance-storm occurred on top of 6.3 feet of sea-level rise, facilities that may be vulnerable include the Hampton Police Station and Fire Station; the Hampton and Seabrook wastewater treatment facilities; the Durham primary sewer lift station; and the Riverwalk/Schanda Park and the Creighton Street Pump Station, both in Newmarket. By a wide margin, critical structures and facilities in the Great Bay municipalities are at much lower risk from sea-level rise and storm surge flooding than those in the Atlantic Coast municipalities according to the findings of the Tides to Storms and C-RiSe vulnerability assessments. This is in part because there is enough topographic relief along the interior coastline to prevent widespread flooding and historic settlement patterns were focused upriver from coastal areas.

The figure below shows the number of different types of assets in the seven Atlantic Coast communities that may be inundated under different sea-level rise and storm surge scenarios. The second figure shows the same results for the ten Great Bay communities.



Potential sea-level rise and storm surge inundation of assets in Atlantic coast communities *(Source: NHCRHC)*



Potential sea-level rise and storm surge inundation of assets in Great Bay communities *(Source: NHCRHC)*

Historic Resources

Coastal New Hampshire contains a rich assortment of such resources, including some of the oldest indigenous settlements in the state dating back 12,500-13,000 years before present (B.P.). During the earliest years of settlement the environment consisted of open tundra and lower sea levels than present day. It is suspected that many of the earliest sites dating to 10,000 B.P. along the Seaboard Lowland lie just offshore and are inundated. Of the 581 archaeological properties recorded in Rockingham and Strafford Counties, 102 sites are located below the 20 foot mean sea level and are considered at risk. With exploration by the English beginning around 1603 in the region, and settlement beginning in the 1620s and 1630s, the cultural and historical resources of the Atlantic Coast and Great Bay regions of New Hampshire are rich traditions that are key to the identity of New Hampshire and a major coastal flood event or chronic flooding from sea-level rise would put that identity at risk.

Future Potential Losses

Total Hazus estimated flood losses for the 17 coastal zone communities are summarized in the table below.[216,217]

Total Estimated Potential Loses for Flood Event Scenarios in Coastal New Hampshire Communities

	Total Estimated Potential Losses[1] for Flood Event Scenarios in Coastal New Hampshire Communities									
	Total Inventory	10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized ($/yr)
	Estimated Value	Dollar Losses[2]	Loss Ratio[3]	Dollar Losses[2]	Loss Ratio[3]	Dollar Losses[2]	Loss Ratio[3]	Dollar Losses[2]	Loss Ratio[3]	Dollar Losses[2]
Dover	$6,102,080,000	$37,537,000	1%	$50,368,000	1%	$57,940,000	1%	$82,621,000	1%	$4,752,000
Durham	$2,357,650,000	$14,739,000	1%	$19,526,000	1%	$22,385,000	1%	$28,103,000	1%	$1,802,000
Exeter	$3,100,191,000	$33,085,000	1%	$47,861,000	2%	$56,031,000	2%	$58,874,000	2%	$4,304,000
Greenland	$484,973,000	$2,469,000	1%	$3,123,000	1%	$3,083,000	1%	$4,517,000	1%	$294,000
Hampton	$4,343,390,000	$49,146,000	1%	$57,688,000	1%	$82,019,000	2%	$116,756,000	3%	$5,876,000
Hampton Falls	$546,407,000	$1,906,000	<1%	$2,655,000	<1%	$2,962,000	1%	$4,253,000	1%	$262,000
Madbury	$338,761,000	$142,000	<1%	$243,000	<1%	$276,000	<1%	$429,000	<1%	$21,000
New Castle	$290,321,000	$7,945,000	3%	$13,186,000	5%	$15,047,000	5%	$19,440,000	7%	$1,103,000
Newfields	$341,218,000	$333,000	<1%	$334,000	<1%	$433,000	<1%	$699,000	<1%	$39,000
Newington	$802,827,000	$2,668,000	<1%	$3,523,000	<1%	$3,828,000	<1%	$5,237,000	1%	$315,000
Newmarket	$1,490,058,000	$2,170,000	<1%	$3,397,000	<1%	$4,599,000	<1%	$7,276,000	<1%	$312,000
North Hampton	$1,066,530,000	$1,668,000	<1%	$1,988,000	<1%	$2,510,000	<1%	$3,237,000	<1%	$194,000
Portsmouth	$6,996,817,000	$94,501,000	1%	$137,829,000	2%	$152,566,000	2%	$197,823,000	3%	$11,980,000
Rollinsford	$418,273,000	$1,680,000	<1%	$2,233,000	1%	$3,316,000	1%	$4,285,000	1%	$221,000
Rye	$1,427,941,000	$36,948,000	3%	$49,390,000	3%	$54,095,000	4%	$68,887,000	5%	$4,531,000
Seabrook	$1,740,448,000	$12,973,000	1%	$15,823,000	1%	$21,625,000	1%	30,294,000	2%	$1,578,000
Stratham	$1,704,096,000	$1,573,000	<1%	$3,117,000	<1%	$4,477,000	<1%	$5,493,000	<1%	$251,000
TOTAL	**$33,551,981,000**	**$301,483,000**	**<1%**	**$412,284,000**	**1%**	**$487,192,000**	**1%**	**$638,224,000**	**2%**	**$37,835,000**

[1] Total Loss = Total Building / Contents[4] + Business Disruption[5]

[2] Losses shown are rounded to nearest $10,000 for values under $100,000 and to the nearest $100,000 for values over $100,000.

[3] Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to nearest integer percent.

[4] Total Building / Contents Loss = Residential Building / Contents Loss + Commercial Building / Contents Loss + Other Building / Contents Loss.

[5] Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

[216] FEMA (2016). Flood Risk Report, Rockingham County, New Hampshire: https://map1.msc.fema.gov/data/FRP/FRR_33017C_20160419.pdf?LOC=e426056eb2e10dc0b6819ef51afa450f

[217] FEMA (2016). Flood Risk Report, Strafford County, New Hampshire: https://map1.msc.fema.gov/data/FRP/FRR_33015C_20160915.pdf?LOC=8edb0eb26b8c117817e60f94b466969e

Flood risk categories (i.e., very low, low, medium, high, and very high) for census blocks that have flood risk are depicted in the Flood Risk Maps for Rockingham[218] and Stafford County.[219] Flood risk is based on the 0.1% annual chance total asset loss by census block. While FEMA-mapped FIRMs only consider historical flood extent, the 1.7 feet sea-level rise scenario map is mostly contained within the current 0.1% annual chance floodplain, with minor incursions into the 2% annual chance floodplain and other low lying areas. Flooding expands beyond the 0.1% annual chance floodplain under higher sea-level rise scenarios. This means that if sea-level rise reaches higher projections, today's one-percent-annual-chance floods could occur twice every day and the new one percent-annual-chance floods will likely reach further upland.

Extreme Temperatures

There is ample evidence that the climate of New Hampshire is changing rapidly as growing seasons lengthen, more frequent hot days are observed, and the number of days with snow cover is decreasing. The NOAA State climate summary states that while the amount of precipitation in winter is increasing and is projected to increase by more than 10-15% by the middle of the 21st century, the amount of recorded snowfall is declining at the majority of observation stations. This is likely due to the fact that while there is an increased amount of precipitation in winter, more of it is now falling as sleet, freezing rain, or rain instead of snow due to warmer winter temperatures. Furthermore, snowfall that is accumulating is melting more quickly overall. These warming winter conditions are already putting strain on local economies that rely on snow for tourism activities, such as mountain resorts for skiing and snowboarding, ice climbing, tubing, and all related shops that supply gear for these activities. Studies[220,221] have shown that the ski season in New England is shrinking as the climate warms, causing ski areas to increase the amount of days that they spend snowmaking and significantly increasing their operational costs. While ski areas and other winter recreation activities and associated businesses are impacted by warmer winters, sales at hotels, restaurants, retail shops, grocery stores, and State Liquor Stores are also directly affected as fewer visitors stay and spend money during the winter season.

Average annual temperatures have increased overall in New Hampshire in the current century. The National Weather Service in Gray, ME produces an Annual Climate Summary for the City of Concord, NH and tracks the top 10 warmest years on record. The top 10 record includes data from 1868 to 2016 (the year 2017 was not completed at the time of this report). Of the top 10 hottest years on record, four occurred within the 21st century[222]: 2006, 2010, 2012, and 2016.

The average annual temperature is expected to continue to increase. The NOAA State climate summary states that even in a scenario with lower GHG emissions that the present day, average annual temperatures are projected to exceed historical record levels by the middle of the 21st century. Under a higher than present day GHG emissions scenario, "historically unprecedented" warming is anticipated to occur by the end of the 21st century. There are very few projections that show a decrease in average annual temperature. This likely increase in average annual temperature across the State will lead to more

[218] FEMA (2016). Flood Risk Map: Rockingham County, New Hampshire: https://map1.msc.fema.gov/data/FRP/FRM_33015C_20160915.pdf?LOC=bef67015322984ef0c3c10e7f83b4d5d

[219] FEMA (2016). Flood Risk Map: Strafford County, New Hampshire: https://map1.msc.fema.gov/data/FRP/FRM_33017C_20160419.pdf?LOC=9bfeaaee447e3cb4b0e8fac13878d24e

[220] https://scholars.unh.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1180&context=soc_facpub

[221] https://www.cabdirect.org/cabdirect/abstract/20143357113

[222] https://www.weather.gov/images/gyx/Climo/CONAnnT.png

frequent and intense heat waves, a greater number of precipitation events falling as rain rather than snow, earlier ice outs on lakes, and a continued decline in days with snow cover.

The NOAA State climate summary also reports that under a higher GHG emissions scenario, it is projected that New Hampshire will see an increase in the number of days with temperatures above 90°F (54 days in southern New Hampshire, and 38 days in northern New Hampshire). The human health impacts of this dramatic increase in hot days would be widespread. Vulnerable populations, including a rapidly growing geriatric community, are extremely susceptible to the effects of extreme temperatures in New Hampshire. The majority of citizens in the State do not have air conditioning in their homes making coping with extreme heat a growing concern. Furthermore, these sensitive populations, including those with access and functional needs, often have limited mobility and would be unable to seek out cooler environments in a climate scenario that brings a significant increase in the number of days with extreme heat.

An increase in the average annual temperature in New Hampshire will have far reaching impacts beyond a potential decrease in winter tourism and an increase in public health concerns. Longer growing seasons that result from a shorter winter will benefit some farmers by allowing for larger crop production, but many valuable crops, such as apples and blueberries, are temperature sensitive and may cease to thrive in a warmer climate. Warmer temperatures slow weight gain in livestock, reduce the volume of milk produced by dairy cows, and increase the potential for heat stress on these animals. Furthermore, persistent warmer temperatures will increase the amount of water that these animals consume, and this, coupled with high feed prices and potential drought, will increase the cost of milk production and further restrict an already razor thin profit margin that New Hampshire dairy farmers currently face.

Capability Assessment

As part of the State Multi-Hazard Mitigation Plan Update 2018, the State Hazard Mitigation Planning Committee (SHMPC) reviewed and evaluated the effectiveness of both the pre-disaster and post-disaster mitigation capabilities, including Laws and Regulations, Funding, Programs and Plans, and Staffing and Training, for the State of New Hampshire at the second stakeholders meeting held on April 6th 2018. As shown below, each capability was reviewed and identified as either Highly Effective, Effective, Neutral, Ineffective, or Highly Ineffective. The SHMPC discussed changes and improvements, as well as suggestions, since the 2013 Plan. Certain capabilities were removed/deleted as they no longer exist or were specifically preparedness/response oriented. During this process, gaps were identified and considered in creation of the 2018 mitigation actions.

State Capability Assessment Table

• **Highly Ineffective**	State Capability Assessment 2018
• **Ineffective**	
• **Neutral**	
• **Effective**	
• **Highly Effective**	

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Type of Hazard Mgt. Capability		Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
			Pre-Disaster	Post-Disaster				
Laws & Regulations								
2009 International Residential Code (IRC) and the **2009** International Building Code (IBC)	State	All Hazards	**X**	**X**	Building codes which govern both residential and non-residential structures	Ineffective	N/A	Update to most recent building codes.
Senate Bill 452	State Legislature	Coastal Flooding	**X**	**X**	Senate passed bill 452 in 2016, which requires agencies that do any planning/construction in coastal regions to consult the NHDES Coastal Program	Effective	**New** Capability added since 2013 Plan	

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Laws and Regulations								
State Executive Order 96-4	State	Coastal Flooding; Inland Flooding	X	X	Mandates all State agencies comply with the flood plain management requirements of all local communities participating in the National Flood Insurance Program (NFIP) in which State-owned properties are located	Effective	N/A	Expand to include other levels of government (i.e. county) and consider requiring higher standards for further flood resiliency.
RSA 141-C	NH DHHS	Infectious Diseases	X	X	Provides broad authority to the department to mitigate and control the spread of infectious diseases. Authorities include surveillance and investigation activities, as well as implementation of control measures such as mandatory testing, treatment, isolation, and quarantine.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Funding								
Clean Water Revolving Fund	State	Emerging Contaminates	X	X	The Clean Water State Revolving Fund (CWSRF) program is a federal-State partnership that provides communities with a permanent, independent source of low-cost financing for a wide range of water quality infrastructure projects.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Coastal Resilience Grant Projects	State (NHDES), Federal (NOAA)	Coastal Flooding	X	X	The NHDES Coastal Program has additional funding to provide annual technical assistance to local planning commissions and communities.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Community Development Block Grant (CDBG)	State, Federal (HUD)	All Hazards		X	HUD provides flexible grants to help cities, counties, and states recover from Presidentially Declared Disasters, especially in low-income areas. In response to Presidentially Declared Disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) Program as Disaster Recovery grants to rebuild the affected areas and provide crucial seed money to start the recovery process.	Neutral	N/A	Improve upon communication and collaboration between State agencies, as CDBG funds can fulfill cost share requirements for potential HMA funded projects

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Funding								
Contribution to Damage Losses	State (NH DOT)	All Hazards		X	(RSA 235:34) is available to any municipality which suffers damage to its highways through a disaster which is estimated to exceed one-eighth (1/8) of one percent (1%) of its assessed valuation providing the Commissioner of Transportation is notified and requested to investigate the damage.	Effective	N/A	No suggested improvements at the time of this Plan update
Emergency Management Performance Grant (EMPG)	State (NH HSEM), Federal (FEMA)	All Hazards	X	X	The Emergency Management Performance Grant (EMPG) Program supports building and maintaining a comprehensive, all-hazards emergency preparedness system. New Hampshire's EMPG Program focuses on planning, organization/administrative (project-driven), equipment, and maintenance/sustainment.	Highly Effective	N/A	Continue to build upon educational outreach to eligible applicants.
Flood Mitigation Assistance (FMA) Program	State (NH HSEM), Federal (FEMA)	Coastal Flooding; Inland Flooding	X		The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to states, territories, federally-recognized tribes and local communities for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. (Nationally Competitive)	Effective	N/A	Continue to build upon educational outreach to eligible applicants.
Hazard Mitigation Grant Program (HMGP)	State (NH HSEM), Federal (FEMA)	Natural Hazards		X	The purpose of HMGP is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters.	Highly Effective	N/A	Continue to build upon educational outreach to eligible applicants.

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Funding								
Highway Block Grant Aid Funds	State (NH DOT)	Aging Infrastructure	X		(RSA 235:23 & :25) Comes from a portion of the total road toll and motor vehicle registration fees collected by the State and given to municipalities for the purpose of constructing, reconstructing, or maintaining Class IV and V highways.	Effective	Decrease in funding	The State continues consider options to address decreased funding for the Program.
Pre-Disaster Mitigation (PDM)	State (NH HSEM), Federal (FEMA)	Natural Hazards	X		Pre-Disaster Mitigation (PDM) provides funds to states, territories, tribal governments, and communities for hazard mitigation planning and the implementation of mitigation projects prior to a disaster event. (Nationally Competitive)	Effective	N/A	Continue to build upon educational outreach to eligible applicants.
Public Assistance and 406 Mitigation	State (NH HSEM), Federal (FEMA)	Natural Hazards		X	Following a Presidential Disaster Declaration, assistance is provided to aid communities within the declared counties. Communities are provided financial reimbursement at a 75/25 cost share to help alleviate some of the expenses that were associated with the incident. All permanent work is assessed for the implementation of potential 406 mitigation by FEMA.	Effective	N/A	Process can be very drawn out resulting in a delay in funds returning to the communities. Consider working with FEMA to improve upon the current process in place.
State Aid Bridge Program for Communities	State (NH DOT)	All Hazards	X	X	(RSA 234) provides 80/20 funding for the construction or reconstruction of structures on Class IV and Class V highways, as well as municipally-maintained bridges on Class II highways. If a town is successful in obtaining FEMA funds for a bridge project, they get 75% to an agreed scope of project. Typically NH DOT will use State Aid Bridge (SAB) to fund 80% of the 25% local match (=20% of project), town pays 20% of 25% (=5% of project). When project costs are greater than scope agreed to with FEMA, SAB pays 80% of that additional cost and locals pay 20%.	Effective	N/A	Consider incorporating use of Cornell precipitation tables

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Funding								
Volunteer Fire Assistance Grant Program	State (NH DNCR - Division of Forests and Lands), Federal (USDA)	Wildfire	X	X	This program provides Federal financial, technical, and other assistance to State Foresters and other appropriate officials to organize, train and equip fire departments in rural areas and rural communities to prevent and suppress fires. A rural community is defined as having a population of 10,000 or less. There is a 50/50 cost share to the community.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Program and Plans								
Automated Hospital Emergency Department Data (AHEDD).	NH DHHS	All Hazards	X		This system was implemented in 2005 and automatically collects real-time Emergency Department (ED) electronic data from hospitals using chief complaint and diagnosis codes (ICD-9 codes) from hospitals statewide. All 26 acute care hospitals in NH participate in the system. Two types of alerts are system generated (8 broad syndrome alerts based on historic data, and reportable disease diagnosis code alerts). Additionally, the system is used to monitor a number of communicable disease and health-risk conditions, and track Influenza-Like-Illness. A custom query tool feature, allows the rapid development of queries to meet unexpected health risk situations, such as the 2009-10 GI Anthrax case investigation and the recent Hepatitis C investigation.	Highly Effective	Technological improvements were applied to the system since the 2013 Plan update	No suggested improvements at the time of this Plan update
Backcountry Avalanche Warning Relay	Federal/Volunteer (NWS and Mount Washington Avalanche Center)	Avalanche	X		NWS Gray began relaying backcountry avalanche warnings from the Mount Washington Avalanche Center to the public through established outreach channels.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
BioSense	CDC; NH DHHS	Infectious Diseases	X		A CDC maintained national integrated syndromic surveillance system that was launched in 2003, which monitors NH resident Veterans Administration and Department of Defense facility patient encounters for 11 syndromes and related LabCorp laboratory test results. NH also sends Emergency Department data from the AHEDD system to contribute to national situational awareness.	Neutral	Expansion to include Emergency Department data.	No suggested improvements at the time of this Plan update
Community Rating System (CRS)	State (NH OSI)	Coastal Flooding; Inland Flooding	X	X	The Community Rating System (CRS) is a voluntary incentive program that encourages communities to adopt and enforce floodplain regulations and activities that go beyond the NFIP minimum requirements.	Neutral	Changes in the scoring of floodplain regulations and activities.	Currently five communities participate within the State. NH OSI will convene a statewide CRS Users Group in 2018 to assist communities to be successful in the program.
Culvert Inspection Program	State (NH DOT, NHDES, NH F & G, and NH HSEM)	Coastal Flooding, Inland Flooding, Tropical Cyclones	X		New Hampshire's stream crossing (culvert) assessment initiative began in earnest in 2014 through a partnership inclusive of the four agencies mentioned, with the University of New Hampshire Technology Transfer Center included as a full partner. The five entities developed a statewide stream crossing assessment database (Statewide Asset Data Exchange System; SADES), and approximately 7000 culverts have been assessed to date statewide. Local towns have expressed an interest in this information to identify and prioritize their most problematic infrastructure from a public safety, condition, and geomorphic compatibility perspective in order to assist in applying for grant funds to upsize culverts.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Dam Safety Emergency Action Program	State (NHDES)	Dam Failure	X	X	This program generates plans for all hazardous dams that not only include response information, but also floodplain mapping and potential downstream impacts (cascading effects).	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
Dam Safety Program	State (NHDES)	Dam Failure	**X**		The primary focus of the program is to ensure that all hazardous dams in the State are inspected at an interval appropriate to the severity of the hazards posed should failure occur.	Effective	N/A	No suggested improvements at the time of this Plan update
Death Data Surveillance	NH DHHS	Infectious Diseases	**X**		NH maintains a unique query tool that facilitates access and prompt analytic capacity to electronically filed death records. These data are accessed from the NH Bureau of Vital Records database for the purpose of monitoring unusual or infectious death occurrences.	Highly Effective	N/A	Suggestion to improve database technology.
DES Master Program Document	State (NHDES)	All Hazards	**X**	**X**	Tim Drew (NHDES) created a document that lists all of the programs (including pre-and post-disaster) that the department can offer.	Effective	**New** Capability added since 2013 plan	Make the document easily accessible.
Emergency Alert System (EAS)	State (NH HSEM)	All Hazards	**X**	**X**	The EAS incorporated digital technology allows emergency messages to be broadcast automatically (or manually) to a specific area.	Effective	N/A	No suggested improvements at the time of this Plan update
Estimated Influenza Activity	NH DHHS	Infectious Diseases	**X**		Overall influenza activity in the State, reported weekly to CDC, is based on reports of ILI, reported numbers of patients with ILI or with fever and/or respiratory symptoms through the emergency department syndromic surveillance systems, reported outbreaks in facilities, and reports of laboratory-confirmed influenza.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Family Preparedness Presentations	State (NH HSEM)	All Hazards	**X**	**X**	NH HSEM has been conducting Family Preparedness Presentations for over six years emphasizing the five phases of emergency management (prevention, mitigation, preparedness, response and recovery), vulnerability to all hazards, as well as mitigation and preparedness actions that can be taken before, during, and after an event.	Highly Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
Fire Weather and Class Day	State (NH DNCR - Division of Forests and Lands)	Wildfire	**X**		NH DNCR keeps daily track of weather conditions and uses the National Fire Danger Rating System to compute the fire class day based on a scale from one to five. Weather observations are collected from remote automated weather stations and tower staff. The department works closely with the NWS for fire weather predictions and the issuance of Fire Weather Watches and Red Flag Warnings when conditions warrant. Class day and expected fire weather conditions are broadcast to fire departments and dispatch centers each day from spring through fall.	Highly Effective	Recently updated notification system to include listserves.	No suggested improvements at the time of this Plan update
FirstNet	State	All Hazards	**X**	**X**	Governor Sununu "Opted-in" to FirstNet on December 28, 2017, a Nationwide Public Safety Broadband Network. This network will improve citizen and responder safety and increase the efficiency and effectiveness of emergency response.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Heat Index Study	State (NH DHHS), Federal (NWS)	Extreme Temperatures	**X**		Revised Heat Advisory threshold. In December 2016, the National Weather Service (NWS) Northeast Region changed its policy on when to issue an official heat advisory. NWS forecast offices in the region will issue heat advisories when the heat index is forecast to reach 95 degrees on two or more consecutive days or 100 on any single day. The previous NWS regional threshold was a maximum daily heat index of 100. This was done as a result of the findings in a study completed by NH DHHS.	Highly Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
HURREVAC/HVX	State (NH HSEM), Federal (FEMA)	Tropical and Post-Tropical Cyclones	**X**		Each hurricane season, FEMA Region I facilitates a review course of the HURREVAC software. The software has now been upgraded by the National Hurricane Program to a web-based platform known as HURREVAC Extended (HVX).	Highly Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
Hurricane Outreach Pre-Storm	State (NH HSEM)	Tropical and Post-Tropical Cyclones	X		Emergency Management Director (EMD) outreach for each event via email updates. NH HSEM sends National Hurricane Center (NHC) information and graphics ahead of each storm for situational awareness.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Information Sharing	State (NH HSEM)	Terrorism/ Violence	X	X	Well established lines of communication with federal, State, and local law enforcement through the NH IAC.	Effective	**New** Capability added since 2013 Plan	Continue to establish lines of communication with entities within the private sector.
Inspection of Bridges	State (NH DOT)	Aging Infrastructure	X	X	(RSA 234:21-:25) NH DOT inspects bridges on all public highways and municipal roads. All maintained bridges on Class II highways are required to be inspected on a two-year basis. Municipalities must keep records of the inspections. These inspections are a requisite for Bridge Aid. The Department will inspect all municipal bridges every two years, provided that sufficient qualified personnel are available to make these inspections.	Effective	Program has been updated to reflect new criteria. Personnel have been trained in an effort to improve upon consistent reporting.	NH DOT has a large amount of bridge inspectors. The program has a very high level of compliance as shown in FHWA's annual report regarding New Hampshire's adherence to the National Bridge Inspection Program requirements set forth in the National Bridge Inspection Standards. Investigate potential funding sources to purchase a new Under-Bridge Inspection Vehicle (UBIV).
Landslide Risk Mapping	State (NHDES, NH HSEM)	Landslide	X	X	Based upon information provided in Local Hazard Mitigation Plans, NH DES Geological Survey has been able to map identified areas where landslides have or are likely to occur.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Lidar Inundation Zone Mapping	State (NH OSI)	Coastal Flooding	X	X	Lidar data has been used to remap flood zones and to create updated Digital Flood Insurance Rate Maps (DFIRMS). This is a joint venture between NH OSI and the NFIP.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
National Flood Insurance Program (NFIP)	State (NH OSI)	Coastal Flooding; Inland Flooding; Tropical Cyclone	X	X	NH OSI administers and coordinates the State's role in the National Flood Insurance Program (NFIP).	Effective	In 2018, NH OSI will complete an update to the State Model Ordinance and develop a menu of higher regulatory standards to encourage NFIP participating communities to adopt standards such as freeboard that goes beyond minimum NFIP requirements and that will further reduce flood risk.	No suggested improvements at the time of this Plan update
National Warning Alert System (NAWAS)	Federal (NAWAS)	Natural Hazards	X		NAWAS provides NH HSEM and NHSP with a backup link to the National Warning Center (NWC), the Alternate National Warning Center (ANWC), and National Weather Service (NWS) offices in Gray, ME and Taunton, MA via protected landline circuits in the event of an emergency.	Effective	N/A	No suggested improvements at the time of this Plan update
New England Seismic Network (NESN)	Regional (NESN), Private (Boston College)	Earthquake	X		Purpose of the NESN is to monitor all earthquake activity in the vicinity of New England and to use the data from this seismic monitoring to better understand the seismic hazard of the region. NESN includes Weston Observatory at Boston College, which is a geophysical research and science education center that conducts research on earthquakes and related geoscience and has been recording earthquakes since the 1930s. Currently, New Hampshire has two seismic stations within the State.	Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
New Hampshire Drought Management Plan	State (NHDES)	Drought		**X**	NHDES and numerous supporting agencies composed the Drought Management Plan in 2016 in an effort to coordinate the State's assessment and response activities in the case of a drought emergency.	Effective	**New** Capability added since 2013 Plan	Continue to build upon this plan and identify potential mitigation actions to plan for the future.
New Hampshire Electronic Disease Surveillance System	NH DHHS	Infectious Diseases	**X**		Under RSA 141-C, approximately 60 conditions are required to be reported by health care providers and laboratories to the NH DHHS. These reported infections are investigated and monitored in this surveillance system, which allows for identification of outbreaks and monitoring of potential health threats. Data are transmitted to CDC for national situational awareness.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
New Hampshire Seacoast Tidal Gauges	New Hampshire Coastal Adaptation Working Group (CAW)	Coastal Flooding	**X**	**X**	Two new tidal gauges have been put in on the seacoast—one in Hampton Harbor and another at Fort Point. These are being used to create flooding predictions for high tide and storm surge events. Locals use these forecasts to move assets ahead of coastal flooding events in an effort to prevent damage to property and close roads as a public safety measure. This data is also being used to document the recurrence of tidal events that cause minor, moderate, and major flooding. These trends will be extremely valuable data for future mitigation studies and actions.	Highly Effective	**New** Capability added since 2013 Plan	Create the ability to archive the tidal gauge data at Hampton Harbor (Fort Point already has this ability).
New Hampshire Trauma and Emergency Medical Services Information System (NH TEMSIS):	FSTEMS	Infectious Diseases	**X**		This web-based system collects data from patient care reports entered by pre-hospital providers after each emergency medical response. This system is maintained by the NH Bureau of Fire Standards & Training and Emergency Medical Services (FSTEMS) and provides real-time data from across the state.	Highly Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
NH DNCR - Division of Forests and Lands - Mutual Aid Agreements (RSA 227-L:5)	State (NH DNCR - Division of Forests and Lands)	Wildfire	**X**	**X**	New Hampshire is a member of the Northeast Forest Fire Protection Compact (NFFPC). It is a large mutual aid organization for the sharing of resources for the purposes of wildland fire training, prevention, and suppression.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
NH HSEM Online Resources	State (NH HSEM)	All Hazards	**X**	**X**	The Department of Safety and Homeland Security and Emergency Management maintains various websites and social media with information on all-hazards and emergency preparedness.	Effective	This capability now includes social media platforms such as Twitter, Facebook, and Instagram.	Suggestions include introduction of multi-lingual and inclusion of higher education in outreach strategy.
Non-Commercial Service Announcements	State (NH HSEM)	All Hazards	**X**	**X**	The NH HSEM Public Information Officer (PIO) manages the agency's public information outreach.	Neutral	N/A	Work on creating a method to measure outreach effectiveness.
Over-the-Counter Pharmaceutical Surveillance (OTC)	NH DHHS	Infectious Diseases	**X**		In NH, a system that contains OTC data from over 150 pharmacies statewide is in use to monitor for health threats in the community.	Neutral	One comprehensive system is used instead of two.	No suggested improvements at the time of this Plan update
Post-Flooding Event Private Well Testing	State (NH DPHS)	Emerging Contaminates, Inland Flooding, Coastal Flooding	**X**	**X**	Program that tests private wells to show when wells are back to normal (free of contaminates) following flooding events	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Redundant Communications Planning	State (NH HSEM)	Long-Term Utility Outage		**X**	Government Emergency Telecommunications Service (GETS) cards and priority lines in place	Effective	**New** Capability added since 2013 Plan	Continue to build out redundancy and unconventional communications methods.
School Absenteeism	NH DHHS	Infectious Diseases	**X**		All public schools were asked to voluntarily report daily aggregate counts for student and staff absenteeism, those absent for ILI, total school nurse visits, and nurse visits for ILI. An analysis tool has been developed, and student absenteeism and student ILI rates, reported by SAU, are posted on the DHHS website each week.	Neutral	N/A	Suggestion to continued increase in volunteer participation.

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
Silver Jackets	State (NH HSEM, NHDES, NH OSI, NH DOT, NH DHR, and NH Fish and Game), Federal (FEMA, NWS, USACE, and USGS)	Flooding	**X**	**X**	Silver Jackets: The original incarnation (Post-Irene River Response Team) was formed on October 14, 2011, and officially became the New Hampshire Silver Jackets on January 21, 2015. A team of individuals from both federal and State agencies that focus on New Hampshire's flood risk management priorities and provide technical expertise and resources in the development of solutions and projects when possible. **Goals and Tasks** •To build a strong team of agencies and programs with specific skills and knowledge related to flood risk identification and mitigation. •To advise and assist New Hampshire communities in their efforts to become more resilient and less vulnerable to flood hazards. •To increase public awareness and understanding of the risks and mitigation of flood hazards through the sharing and uniform delivery of information and resources to the communities of New Hampshire. •To foster partnerships and facilitate cooperation in achieving flood risk reduction. •To assist with the prioritization of risk management tasks during individual flood incidents.	Highly Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
State Critical Infrastructure Key Resources Tracking	State (NH IAC), Federal (DHS)	All Hazards	**X**	**X**	List of all critical infrastructure locations and types/sectors are maintained by the NH IAC in partnership with DHS. The State has approximately 4-5 federal level Critical Infrastructure (CI) sites, and approximately 220 CI sites that are rated using New Hampshire's rating system (since much of our CI is not large enough to meet the criteria on the federal list). This allows for better allocation of funds.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
State Emergency Operations Plan (SEOP)	State (NH HSEM)	All Hazards	**X**	**X**	The SEOP was developed in accordance with standards of the National Response Framework (NRF), the National Incident Management System (NIMS), and other related guidelines and regulations. Ensures an efficient response to a disaster, thus minimizing the impact and recovery of a disaster.	Effective	Updated annually	ESF 6 and 8 are currently working to revise their annexes.
Variable Message Sign Program	State (NH DOT, NH HSEM)	All Hazards	**X**	**X**	Messaging available along State roads at the request of NH DOT. Some locations along major highways have permanent variable messaging signage, and mobile messaging signs are available. NH HSEM assists in coordinating municipal requests for the portable messaging boards.	Effective	**New** Capability added since 2013 Plan	No suggested improvements at the time of this Plan update
Virologic Surveillance	CDC; NH DHHS	Infectious Diseases	**X**		The NH Public Health Laboratories (PHL) isolates and subtypes influenza viruses year round and transmits these data electronically to CDC via the Laboratory Information Management System (LIMS)	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Well Replacement Program	State (NH DOT)	Emerging Contaminates	**X**	**X**	The Well Replacement Program investigates and replaces private water supplies contaminated with chloride caused by highway operations and is administered by the Well Section within the Bureau of Highway Maintenance.	Effective	**New** Capability added since 2013 plan	No suggested improvements at the time of this Plan update
Wildland Fire Management Program	State (NH DNCR - Division of Forests and Lands)	Wildfire	**X**	**X**	The primary focus of the program is to provide wildland fire training, prevention, planning, and suppression assistance to communities throughout New Hampshire.	Highly Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Programs and Plans								
Wildland Fire Prevention Program	State (NH DNCR - Division of Forests and Lands)	Wildfire	X		Program highlights include: Smokey Bear appearances at schools and large events, prevention posters, pamphlets, television PSA's, and a prevention trailer to take to fairs, etc. In addition, the two department forest rangers are trained in Firewise and give public talks to homeowner associations regarding the risks of wildland fires to rural homes. A third emphasis of the prevention program is the development of Community Wildfire Protection Programs (CWPP) to recognize and make recommendations for the mitigation of high hazard/risk areas.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Staffing & Training								
Bureau of Building Safety and Construction	State (NH FMO)	All Hazards	X		The Bureau of Building Safety and Construction houses three sections, which include the Engineering Section, Mechanical Safety Section, and the Modular Building Section.	Effective	The program has experienced the addition of extremely knowledgeable staff resulting in more control over State projects.	Run licensing checks.
Bureau of Investigations	State (NH FMO)	Conflagration, Hazardous Materials, Wildfire		X	Investigates all fires, building collapses, and carbon monoxide releases (other than from a motor vehicle) that result in a death. (RSA 153:19). In addition, the bureau investigates all fires involving State owned property, as well as other fires and explosions at the request of the local officials. (RSA 153:18; RSA 153:12). The bureau investigates fires of suspicious origin seeking to arrest and prosecute those responsible (RSA 153:11). The division also provides coordination of all mutual aid districts in the State.	Effective	N/A	No suggested improvements at the time of this Plan update
Bureau of Special Operations and Communications	State (NH FMO)	Hazardous Materials	X		The Bureau of Special Operations is responsible for four major functional areas. The sections within the bureau include the Hazardous Materials Section, Fireworks Section, Public Education Section and Data Analysis Unit.	Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Staffing & Training								
Cyber Training Program	State	Cyber Event	**X**	**X**	SANS Securing the Human Cyber Security Training for State Employees	Effective	**New** Capability added since 2013 Plan	Continue required annual training.
Emergency Management Academy	State (NH HSEM)	All Hazards	**X**	**X**	Online platform available to all emergency management personnel and the public that allows individuals to complete training on and enhance awareness of a multitude of emergency management related topics.	Effective	**New** Capability added since 2013 Plan	New outreach strategies are being developed to make the program more widespread, and more courses are being added. Weather 101 and Severe and Hazardous Weather courses are currently in the process of being added to the list available on the site.
Forest Fire Warden Program (RSA 227-L:7)	State (NH DNCR - Division of Forests and Lands)	Wildfire	**X**		New Hampshire has a Forest Fire Warden appointed in every town in the State, including unincorporated places, to carry out the duties and functions of the department. In addition to the Wardens, there are approximately 2,000 Deputy Wardens. Special Deputy Forest Fire wardens are also available to assist the State forest rangers.	Effective	N/A	No suggested improvements at the time of this Plan update
Law Enforcement (Forest Rangers)	State (NH DNCR - Division of Forests and Lands)	Wildfire	**X**		NH DNCR has 11 sworn forest rangers that enforce various laws for the prevention of wildland fires. Other enforcement responsibilities include wildfire arson investigation, wildfire cause, and origin determination.	Effective	N/A	No suggested improvements at the time of this Plan update
NH HSEM Field Representatives	State (NH HSEM)	All Hazards	**X**	**X**	HSEM Field Representatives participate in hazard mitigation training as well as the development of local hazard mitigation plans. The Field Representatives are assigned to assist communities with development of Local Emergency Operations Plans, Local Hazard Mitigation Plans, applying for mitigation funding, conducting exercises and training, as well as providing overall support to their respective communities in the field of emergency management.	Effective	N/A	No suggested improvements at the time of this Plan update

Capability (Program, Policy, Regulation, etc.)	Agency (Federal, State, Local, Private)	Hazard	Pre-Disaster	Post-Disaster	Description of Capability	Effectiveness	Changes/Improvement Since 2013 Plan	Suggested Improvements/Comments
Staffing & Training								
Regional Planning Commissions	Quasi-Governmental	All Hazards	X		Regional Planning Commissions (RPCs) provide technical assistance with community planning to local jurisdictions. These include Hazard Mitigation Plans, Floodplain Ordinances, and Emergency Operation Plans.	Highly Effective	N/A	No suggested improvements at the time of this Plan update
Programs Removed from the 2013 Plan								
Incident Management Plan	State (NH DOT)						Deleted - Program is specifically for response activities.	
New Hampshire Mutual Aid for Public Works	State; Local						Deleted - Program is specifically for response activities.	
Comprehensive Emergency Management Planning for Schools (CEMPS)	State (NH HSEM)						Deleted - Program no longer exists.	
Early Warning Infectious Disease Surveillance (EWIDS)	NH DHHS						Deleted - Program no longer exists.	
Real-time Outbreak and Disease Surveillance (RODS)	NH DHHS						Deleted - Duplicative of Over-the-Counter Pharmaceutical Surveillance (OTC)	
School Surveillance	NH DHHS						Deleted - Program no longer exists.	
U.S. Influenza Sentinel Provider Surveillance Network Participation	NH DHHS						Deleted - Duplicative of Influenza Monitoring Program	

	Preparedness/Response
	No Longer Exists

Local Capability Assessment

Homeland Security and Emergency Management has been actively working with Regional Planning Commissions, contracted planners, and local communities to develop Local Hazard Mitigation Plans and identify cost-effective mitigation measures. The State has adopted NH Revised Statues Annotated - RSA 674:2, which states that a Master Plan adopted under this statute may include a "natural hazards section which documents the physical characteristics, severity, frequency, and extent of any potential natural hazards to the community. It should identify those elements of the built environment at risk from natural hazards as well as extent of current and future vulnerability that may result from current zoning and development policies." [223]

Summary of Local Capability Assessment

Local Hazard Mitigation Plans that are submitted to New Hampshire Homeland Security and Emergency Management (NH HSEM) include their own individual local capability assessments. These local assessments contain a review of the effectiveness of each community's programs by the local hazard mitigation committees. NH HSEM provides technical assistance and recommendations for improving a given community's programs, but the local government policies, programs, and the implementation of their hazard mitigation plans is the responsibility of the local government. Local towns and cities, however, are not required by law to implement the State's recommendations.

The matrix below provides an overview of programs and regulations for most of the communities in New Hampshire. The overall effectiveness of these programs is assessed at the local level in the Local Hazard Mitigation Plan. NH HSEM has reviewed the local plans and has determined that these common actions in local hazard mitigation plans are reflected in the matrix below and has determined that all of these programs range from adequate to excellent in quality with no changes needed. The individual assessment by the local plans identify whether or not they need improvement. If a problem is identified NH HSEM will provide technical assistance to those individual communities.

Local Emergency Operations Plan (LEOP)
Building Codes
Floodplain Ordinance
Elevation Certificates
Community Rating System (CRS)
Emergency Warning System (EWS)
Subdivision Regulations
Site Plan Regulations
Road Design Standards
Bridge Design Standards
Bridge Maintenance Program
Storm Drain/Culvert Maintenance
Aquifer Protection District
Shoreland Protection Program
Hazardous Materials Plan/Team

[223] http://www.gencourt.state.nh.us/rsa/html/LXIV/674/674-2.htm

Public Education Programs
Master Plan
Wetland Conservation District
Capital Improvement Program
Emergency Back-up Power
Mitigation Grants
Fluvial Erosion Hazard Zoning Ordinance

Current Protection Program or Activity	Responsibility	Effectiveness	Recommendations for Improvements / Comments
Emergency Operation Plan	Local Jurisdiction/EMD	Good	None
Building Code	Local Jurisdiction	Good	Could be substantially improved by adopting more up-to-date Building Codes
Floodplain Ordinance	Local Jurisdiction/Selectboard	Good	None
Elevation Certificates	Local Jurisdiction/Planning Board	Good	None
Community Rating System	Local Jurisdiction/Selectboard	Good	None
Emergency Warning System	Local Jurisdiction/Selectboard	Good	None
Subdivsion Regulations	Local Jurisdiction/Planning Board	Good	None
Site Plan Regulations	Local Jurisdiction/Planning Board	Good	None
Road Design Standards	Local Jurisdiction/EMD	Good	None
Bridge Design Standards	Local Jurisdiction/EMD	Good	None
Bridge Maintenance Program	Local Jurisdiction/EMD	Good	None
Storm Drain/Culvert Maintenance	Local Jurisdiction/EMD/Road Agent	Good	None
Aquifer Protection District	Local Jurisdiction/EMD	Good	None
Shoreland Protection Program	Local Jurisdiction/Selectboard	Good	None
Haz. Materials Plan/Team	Local Jurisdiction/Fire Chief	Good	None
Public Education Programs	Local Jurisdiction/School Board	Good	None
Master Plan	Local Jurisdiction/Selectboard	Good	None
Wetland Conservation District	Local Jurisdiction/	Good	None
Capital Improvement Program	Local Jurisdiction/Selectboard	Good	None
Emergency Backup Power	Local Jurisdiction/EMD	Good	None
Mitigation Grants	Local Jurisdiction/EMD	Good	None
Fluvial Erosion Hazard Zoning	Local Jurisdiction/EMD	Good	None
Community Development Block Grant (CDBG)	Provides annual grants on a formula basis to entitled cities, urban counties, and states to develop viable urban communities by providing decent housing and a suitable living environment, and by expanding economic opportunities, principally for low- and moderate-income persons	Improvements for Public Infrastructure and Housing. Property Acquisitions	Housing and Urban Development (HUD)

Review Process of Local Plans and Projects

Plan Review

All plans completed by the Regional Planning Commissions (RPCs), contracted planners, and local communities, regardless of funding sources, are submitted to HSEM for review. As of December 5, 2016 the State of New Hampshire was awarded Program Administration by States (PAS). Under this Operational Agreement with the Federal Emergency Management Agency (FEMA), the State maintains the authority to award Formal Approval once a Local Hazard Mitigation Plan meets all FEMA requirements in accordance with 44 CFR Part 201.6.

The State Hazard Mitigation Planner (SHMP) and State Hazard Mitigation Officer (SHMO) review each plan using FEMA's Local Hazard Mitigation Plan Review Guide effective October 1, 2011. This initial review is completed within 45 days. If the State identifies revisions the Plan is returned to the RPC, contracted planner, or local community for implementation and resubmission. Once revisions are made and approved by NH HSEM Approvable Pending Adoption (APA) status is awarded to the community. The community will formally adopt the Plan and the final adopted Plan will be forwarded to NH HSEM for Formal Approval.

The official FEMA Approval Letter and date of the approved Plan is sent to NH HSEM, RPC/contracted planner, and community official. All formal approved plans are kept at NH HSEM via electronic file.

As NH HSEM staff reviews local Hazard Mitigation Plans, information that is applicable to a regional or State level of planning will be collected and available within 60 days for inclusion to future revisions of the State Hazard Mitigation Plan. Likewise, sections of the State Plan are posted on the NH HSEM Resource Center website for local communities, Regional Planning Commissions, contracted planners and the general public to incorporate into their Local Hazard Mitigation Plans. Out of 234 total communities, the State of New Hampshire has 231 plans that are currently within some form of review, approval, or adoption/implementation.

Project Review

The SHMO is responsible for project management and record keeping, including project files that contain all correspondence, applications, vouchers, reports, receipts, and related documentation. NH HSEM support staff will assist in the preparation of the state/local grant agreement, all correspondence and project files. Quarterly progress reports will be submitted to FEMA by the SHMO based on the reports provided by the Applicant's Agent. A final report will also be required from each applicant, and closeout documents will be submitted to FEMA by the SHMO.

Mitigation Project Closeout procedures required by the communities include the following:

- The subrecipient shall submit closeout information in the form of a final report on work done, expenditures, and other costs.
- Project closeout will be noted in the project files.
- Final payment shall be made along with a closeout letter.

Prioritization of Local Planning & Projects

Mitigation Planning is a high priority for New Hampshire Homeland Security and Emergency Management (NH HSEM). The RPC's or contracted planners complete the majority of mitigation plans within the State and select communities based on population, hazard risk, and a community's interest

and involvement in mitigation. NH HSEM also provides direct technical assistance to communities that develop plans on their own.

Prioritization of mitigation projects typically fall under the Hazard Mitigation Grant Program (HMGP). All PDM project applications submitted to the State will also be reviewed under the following HMGP requirements:

1. Project Review Process:

- The State Hazard Mitigation Officer (SHMO) will review all applications for completeness and to ensure they meet State and Federal eligibility criteria.
- A Cost Benefit Analysis will be conducted on all projects submitted utilizing FEMA BCA software.
- The Interagency Hazard Mitigation Team (IHMT) will review and make funding recommendations on the applications. This is to be based on communities with the highest risk and the greatest pressures caused by development.
- The SHMO will provide the Director of HSEM, in prioritized order; those grant applications recommended for FEMA approval by the IHMT.
- The Director of HSEM and the SHMO will forward applications to FEMA for funding approval.

2. Project Ranking Process and Criteria:

The IHMT will rank all eligible projects. Ranking will include consideration based on meeting the following:

- Objectives and criteria within the State Hazard Mitigation Plan
- Federal and State criteria as outlined earlier in this document
- 44 CFR Section 206.435 (b)
- Membership in the National Flood Insurance Program
- FEMA-approved Hazard Mitigation Plan
- Communities with the highest level of risk
- Repetitive Loss Property
- Communities feeling the highest pressures caused by development
- Available funding

Applicants will be formally notified of the results of the Committee's ranking and reviewing process, and of their recommended or non-recommended status by the SHMO. Applicants not being recommended for funding may appeal the Committee's decision under specific criteria.

3. Selection of Projects:

The SHMO will submit to the Director of NH HSEM those projects that have been reviewed and ranked by the IHMT, and are recommended for submission to FEMA for final approval and funding.

Mitigation Strategy

The SHMPC met on May 18, 2018 to identify new mitigation actions for the 2018 Plan in accordance with the goals and objectives listed below.

Overarching Goals

The following are the five overarching goals of this Plan:

- Minimize loss and disruption of human life, property, the environment, and the economy due to natural, technological, and human-caused hazards through a coordinated and collaborative effort between federal, State, and local authorities to implement appropriate hazard mitigation measure
- Enhance protection of the general population, citizens, and guests of the State of New Hampshire before, during, and after a hazard event through public education about disaster preparedness and resilience, and expanded awareness of the threats and hazards which face the State
- Promote continued comprehensive hazard mitigation planning at the State and local levels to identify, introduce, and implement cost effective hazard mitigation measures
- Address the challenges posed by climate change as they pertain to increasing the risk and impacts of the hazards identified within this plan
- Strengthen Continuity of Operations and Continuity of Government across the State and local levels to ensure continuation of essential services

Natural Hazard Objectives

- Reduce long-term flood risks through assessment, identification, and strategic mitigation of at risk/vulnerable infrastructure (dams, stream crossings, roadways, coastal levees, etc.)
- Minimize illnesses and deaths related to events that present a threat to human and animal health
- Assist communities with plan development, outreach, and public education in order to reduce the impact from natural disasters
- Ensure mitigation strategies consider the protection and resiliency of natural, historical, and cultural resources.

Technological Hazard Objectives

- To ensure technological hazards are responded to appropriately and to mitigate the effect on citizens.
- Build upon State capabilities to identify and respond to emerging contaminates
- To effectively collaborate between federal, State, and local agencies as well as private partners, NGOs, and VOADs
- Enhance public education of technological hazards to assist in the prevention and mitigation of hazard impacts on the population
- Ensure HAZMAT teams are properly equipped and trained to respond, contain, and mitigate incidents involving technological hazards
- Reduce the possibility of long-term utility outages by planning, training, and exercising on utility failure events

- Lessen the effects of technological hazards on communications infrastructure by building more resilient voice and data systems

Human-caused Hazard Objectives

- Ensure that grant related funding processes allow for expedient and effective actions to take place at the community and state-level
- Identify Critical Infrastructure and Key Resources (CIKR) risks or vulnerabilities and protect or harden State infrastructure against hazards
- Improve the ability to respond and mitigate Cyber Events through increased training, exercising, improved equipment, and utilizing the latest technologies
- Foster collaboration between federal, State, and local agencies on training, exercising, and preparing for mass casualty incidents and terrorism
- Ensure State assets (i.e. Hospitals, state agencies, non-profits, universities, etc.) are prepared for all phases of emergency management including training and exercising on reunification

Prioritization of Action Items

Once the SHMPC compiled a list of new, ongoing, and deferred mitigation actions, the group utilized the SHMPC Prioritization Criteria Worksheet *(Appendix D)* to rank the actions based on the following:

- Life Safety – How effective will this action be at protecting lives and preventing injuries?
- Property Protection – How significant will the action be at eliminating or reducing damage to structures and infrastructure?
- Technical – Is the mitigation action technically feasible? Is it a long-term solution?
- Political – Is there overall public support?
- Legal – Does the State have the authority to implement the action?
- Environmental – What are the potential environmental impacts?
- Economic – What are the costs and benefits? Does the cost seem reasonable?
- Social – Will the proposed action adversely affect one segment of the population?
- Administrative – Does the State have the personnel and admin capabilities?

These criteria were rated on a scale from 1-5, with 5 being the most effective and 1 being the least effective. Each score determined by individual stakeholders was used to calculate an average final priority value.

Action Plan for Implementation

The prioritized actions were compiled into the following table to identify a lead agency and potential funding source. Actions with a multi-agency lead include one or more of the agencies involved in the SHMPC. The SHMPC strives to complete actions within the lifespan of this Plan; however, due to funding and staffing restrictions, actions which are not completed within this time frame will be re-evaluated within the 2023 Plan update.

Potential Funding Opportunities

Potential funding opportunities are identified for each mitigation action shown in the following table. *Note: This is not a complete list of potential mitigation funding opportunities and will continue to be expanded upon and revised during each Plan update cycle.*

Community Development Block Grant (CDBG) Grant Disaster Recovery Program - Housing and Urban Development (HUD) provides flexible grants to help cities, counties, and States recover from Presidentially Declared Disasters, especially in low-income areas. These grants are subject to availability of supplemental appropriations. In response to Presidentially Declared Disasters, Congress may appropriate additional funding for the Community Development Block Grant (CDBG) Program as Disaster Recovery Grants to rebuild the affected areas and provide crucial seed money to start the recovery process.[224]

Emergency Management Performance Grant (EMPG) Program - The purpose of the Emergency Management Performance Grant (EMPG) Program is to provide federal funds to states to assist state, local, territorial, and tribal governments in preparing for all hazards, as authorized by Section 662 of the Post Katrina Emergency Management Reform Act (6 U.S.C. § 762) and the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. §§ 5121 et seq.).The EMPG Program will provide federal funds to assist state, local, tribal, and territorial emergency management agencies to obtain the resources required to support the National Preparedness Goal's (the Goal) associated mission areas and core capabilities.[225]

Flood Mitigation Assistance (FMA) Program - The FMA program is authorized by Section 1366 of the National Flood Insurance Act of 1968, as amended with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FMA provides funding to states, territories, federally-recognized tribes and local communities for projects and planning that reduces or eliminates long-term risk of flood damage to structures insured under the NFIP. FMA funding is also available for management costs. Funding is appropriated by Congress annually.[226]

Hazard Mitigation Grant Program (HMGP) Program - The purpose of the Hazard Mitigation Grant Program (HMGP) is to help communities implement hazard mitigation measures following a Presidential Major Disaster Declaration in the areas of the state, tribe, or territory requested by the Governor or Tribal Executive. The key purpose of this grant program is to enact mitigation measures that reduce the risk of loss of life and property from future disasters.[227]

Homeland Security Grant Program (HSGP) - As appropriated by the Department of Homeland Security Appropriations Act, 2018 (Pub. L. No. 115-141), and authorized by the Homeland Security Act of 2002, as amended (Pub. L. No. 107-296), the Department of Homeland Security's (DHS)/Federal Emergency Management Agency's (FEMA) Fiscal Year (FY) 2018 Homeland Security Grant Program (HSGP) provides

[224] https://www.hudexchange.info/programs/cdbg-dr/
[225] https://www.fema.gov/media-library-data/1464196875293-190ed88e1b63940c87121a3f0b97b8a5/EMPG_Multi_Year_Program_Guidance_Final.pdf
[226] https://www.fema.gov/flood-mitigation-assistance-grant-program
[227] https://www.fema.gov/hazard-mitigation-grant-program

funding to states, territories, urban areas, and other local and tribal governments to prevent, protect against, mitigate, respond to, and recover from potential terrorist attacks and other hazards.[228]

National Flood Insurance Program (NFIP) - The National Flood Insurance Program (NFIP) aims to reduce the impact of flooding on private and public structures. It does so by providing affordable insurance to property owners, renters and businesses and by encouraging communities to adopt and enforce floodplain management regulations.[229]

New Hampshire Coastal Resilience Grants (NHDES Coastal Program) - These funds are intended to support engagement to increase understanding of coastal hazards as well as planning, design, permitting, and construction projects that minimize hazards and enhance coastal community resilience. Projects must take place within one or more of the 17 coastal zone communities.[230]

Pre-Disaster Mitigation (PDM) Program - This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. Mitigation planning is a key process used to break the cycle of disaster damage, reconstruction, and repeated damage. PDM grants are funded annually by Congressional appropriations and are awarded on a nationally competitive basis.[231]

Public Assistance (PA) - FEMA's Public Assistance (PA) grant program provides federal assistance to government organizations and certain private nonprofit (PNP) organizations following a Presidential Disaster Declaration. Through the program, FEMA provides supplemental federal disaster grant assistance for debris removal, life-saving emergency protective measures, and the repair, replacement, or restoration of disaster-damaged publicly-owned facilities, and the facilities of certain PNP organizations. The PA program also encourages protection of these damaged facilities from future events by providing assistance for hazard mitigation measures during the recovery process.[232]

Individual Assistance (IA) – The Individual Assistance (IA) program's mission is to ensure that disaster survivors have timely access to a full range of authorized programs and services to maximize recovery through partnered coordination of local, state, territorial, and tribal governments, as well as other federal agencies, non-governmental organizations and the private sector. [233]

State Bridge Aid Program - A municipality desiring to manage the design and construction of a bridge rehabilitation or replacement project may receive State Bridge Aid in compliance with RSA 234. Bridge Aid provided to a municipality under this process shall consist of reimbursement at the rate of 80% of all qualifying costs that are found in compliance with the process, which includes costs incurred for design, construction, and construction engineering.[234]

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[228] https://www.fema.gov/media-library-data/1526578922142-6e8ecdd336887cfb43062fcf7b374f4a/FY_2018_HSGP_Fact_Sheet_FINAL_508.pdf
[229] https://www.fema.gov/national-flood-insurance-program
[230] https://www.des.nh.gov/media/pr/2018/20180507-coastal-rfp.htm
[231] https://www.fema.gov/pre-disaster-mitigation-grant-program
[232] https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit
[233] https://www.fema.gov/media-library/assets/documents/133744
[234] https://www.nh.gov/dot/business/municipalities.htm

New Hampshire State Multi-Hazard Mitigation Plan 2018 Update
2018 Mitigation Actions

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
1	35	Maintain the statewide Reverse 911 system for the dissemination of hazardous situations and emergency events.	**Ongoing**	NH E911	All Hazards	In-Kind	
2	35	Sustain the Emergency Alert System as necessary.	**Ongoing**	NH HSEM	All Hazards	In-Kind	
3	34	Continue implementation and expansion of the NH Alerts program for both the public application and State employee notification.	**New**	NH HSEM	All Hazards	HSGP	
4	34	Provide NFIP training and outreach to communities that encourages sound floodplain management practices and promotes flood hazard mitigation activities and available funding mechanisms.	**New**	NH OSI	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones	In-Kind, NH Coastal Resilience Grants	
5	34	Fund cost –effective Mitigation Projects through available federal grants and local cost share (HMGP, PDM, FMA).	**Ongoing**	NH HSEM	Natural Hazards	FMA, PDM, and HMGP	
6	34	The Dam Bureau will continue to execute dam safety inspections and enforcement programs as needed.	**Ongoing**	NHDES	Inland Flooding / Dam Failure	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
7	34	Maintain NHDES funding and coordinate with other funding sources to replace aging infrastructure. Promote asset management activities at drinking water and wastewater systems.	**New**	NHDES	Aging Infrastructure / Emerging Contaminates	In-Kind, State Bridge Aid Program	
8	33	NH DOT to review and update, as applicable, vulnerability assessments on the 24 critical bridges throughout the State.	**Ongoing**	NH DOT	Aging Infrastructure	In-Kind	
9	33	Sustain NHDOT and UNH - TTC - T2 Program in the development of road design construction, storm water and road drainage standards, including culvert and bridge sizing.	**Ongoing**	NH DOT, UNH	All Hazards	In-Kind	
10	33	Work toward implementing the New Hampshire Coastal Risk and Hazard Commission recommendations related to hazard mitigation.	**New**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding	NH Coastal Resilience Grants, FMA, PDM, HMGP	
11	33	Expand upon current descriptors used for State asset inventory to include data such as location, building material, and hazard vulnerabilities.	**New**	Multi-Agency	All Hazards	In-Kind	
12	33	Identify and address sources of emerging contaminants. Where possible, provide alternate water.	**New**	NHDES	Emerging Contaminates	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
13	33	Organize and train Road Agents, EMDs and "Skywarn" etc. volunteers in affected areas in ice monitoring activities that will enhance the NH-CRREL database.	**Completed and Ongoing**	NH Silver Jackets / CRREL	Inland Flooding / Severe Winter Weather	SJ/USACE	
14	33	Maintain the tips line for the reporting of homeland security concerns	**Ongoing**	NH IAC	Terrorism/Violence / MCI / Cyber Event	In-Kind, EMPG	
15	32	Sustain the New Hampshire Department of Environmental Services and Water Division in the implementation of the State's Drought Management Plan.	**Ongoing**	NHDES	Drought	In-Kind	
16	32	Using materials supplied by National Fire Protection Association (NFPA) and others, the State will utilize and develop public information materials for distribution to appropriate State agencies, regional planning committees and local planning committees. Additionally, the NHSFMO will review and develop (as necessary) Public Service Announcements to alert interested parties to the existence of fire, life safety, and hazardous materials risks.	**Ongoing**	NHFMO	Conflagration, Wildfire, Hazardous Materials	In-Kind	
17	32	Utilize collaborative partnerships, including the NH Coastal Adaptation Workgroup and the Upper Valley Adaptation Workgroup, to conduct outreach, technical assistance and assessments on current and future flood hazard mitigation.	**Ongoing**	NHDES	Coastal Flooding / Inland Flooding	In-Kind, NH Coastal Resilience Grants	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
18	32	Incorporate 500 year flood plain threshold for new construction of drinking water and wastewater facilities in accordance with NEIWPCC's TR-16 Guides for the Design of Wastewater Treatment Works and other similar documents (Revised 2011 Edition).	**Ongoing**	NHDES	Coastal Flooding / Inland Flooding	In-Kind	
19	32	Encourage communities to adopt floodplain management regulations that exceed the minimum NFIP requirements, incorporating higher standards (e.g. freeboard, setback and compensatory storage requirements) that will improve local flood resilience.	**Ongoing**	NH OSI	Coastal Flooding / Inland Flooding	In-Kind, SJ/USACE	
20	32	Incorporate projected sea-level rise, storm surge, and precipitation as well as associated changes in flood levels, currents, groundwater tables, stormwater runoff, and other related impacts into capital improvement projects, permitting, and other state actions.	**Ongoing**	Multi-Agency	Coastal Flooding / Inland Flooding	In-Kind	
21	32	Update storm surge, sea-level rise, precipitation, and other relevant projections recommended in the Coastal Risk and Hazards Commission 2014 report "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Paste and Projected Trends" at least every 5 years, pursuant to Chaptered Law 121.	**Ongoing**	NHDES - Coastal Program	Coastal Flooding / Inland Flooding	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
22	32	Encourage and assist communities with the mitigation of repetitive loss properties acquisition & demolition, relocation or elevation (funding through HMGP, PDM, and FMA).	**Ongoing**	NH HSEM	Coastal Flooding / Inland Flooding	FMA, PDM, and HMGP	
23	32	The Department of Natural and Cultural Resources will continue to assist in the development of the Community Wildfire Protection Plans (CWPP) and other plans and authorities to identify cost effective wildland fire hazard mitigation measures in accordance with the State's Forest Fire Protection Plan.	**Ongoing**	NH DNCR, NH HSEM	Wildfire	In-Kind, PDM, and HMGP	
24	32	Explore potential multi-agency uses of LIDAR data to support mitigation activities, such as holistic watershed flood monitoring.	**New**	NHDES - NHGS	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones	In-Kind	
25	32	Continue to sustain the stream gauge program and identify funding resources to strategic installation of additional stream gauges.	**New**	NHDES	Inland Flooding	In-Kind, USGS	
26	32	NHDES to assist partners in maintaining existing tidal gauge networks at Fort Point and Hampton and improve historical record keeping, forecasting, and outreach related to the ride gauge data.	**New**	NHDES	Coastal Flooding	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
27	32	The SHMO will provide State agencies, local communities, Regional Planning Commissions, private non-profit, and private entities with applicable hazard mitigation outreach regarding the State's initiatives and available resources.	**Ongoing**	NH HSEM	Natural Hazards	FMA, PDM, and HMGP	
28	32	Provide standardized guidance on temperatures, sea-level rise, and precipitation changes, to local communities for incorporation into planning efforts.	**New**	NHDES	Natural Hazards	In-Kind	
29	32	Provide education and outreach for mitigation strategies in reference to pre-event debris management.	**New**	NHDES	Natural Hazards	In-Kind	
30	31	The State will closely support local communities, with assistance from contractors and regional planning commissions, in the creation of single-jurisdiction and multi-jurisdiction hazard mitigation plans.	**Ongoing**	NH HSEM	Natural Hazards	PDM, HMGP	
31	31	Encourage NFIP-participating communities that conduct floodplain management activities exceeding the minimum NFIP requirements to consider joining the Community Rating System (CRS), an NFIP incentive program that provides discounts to flood insurance premiums for some residents and businesses as a reward for the community's activities.	**New**	NH OSI	Inland and Coastal Flooding	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
32	31	Evaluate the impacts of saltwater intrusion and changing groundwater table elevations as a result of sea-level rise and implications for water, waste, and asset/infrastructure management.	**Ongoing**	NHDES / NH DOT / UNH	Coastal Flooding / Inland Flooding	In-Kind	
33	31	NH DOT to identify, analyze, and create design solutions for repeated areas of road closures.	**Ongoing**	NH DOT	All Hazards	In-Kind	
34	31	Promote funding and resources for land acquisition, conservation planning, land management programs, and land stewardship in areas at risk of loss or degradation due to sea level rise.	**Ongoing**	Multi-agency	Coastal Flooding / Inland Flooding	In-Kind, FMA, PDM, and HMGP	
35	31	Provide generators at selected state-owned fuel locations to provide fuel to emergency vehicles during an extended power outage.	**Ongoing**	NH DOT	All Hazards	In-Kind	
36	31	Maintain Program Administration by State (PAS) status allowing for the continued authority to Formally Approve Local Hazard Mitigation Plans.	**New**	NH HSEM	Natural Hazards	HMGP	
37	31	Promote the installation of regionally and locally significant staff gauges, tidal gauges, and other such monitoring equipment as determined to be necessary by local EMDs, Road Agents, etc.	**Ongoing**	USGS/NH HSEM/ Silver Jackets	Coastal Flooding / Inland Flooding	In-Kind, USGS	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
38	31	The SHMO will work with local communities, contractors, and regional planning commissions to develop and maintain lists of public and private facilities considered essential to regional and local interests during/after events within their Local Hazard Mitigation Plans.	**Ongoing**	NH HSEM	All Hazards	PDM, HMGP	
39	31	Promote and educate in the development of increased standards for those facilities that maybe at risk from natural, human-caused, and technological hazards.	**Ongoing**	Multi-Agency	All Hazards	In-Kind	
40	31	State agencies will continue the collaborative development of information dissemination opportunities via many outreach methods, including but not limited to: broadcast media, social media platforms, ReadyNH.gov, Public Service Announcements (run on closed cable networks and broadcast media), printed materials, direct outreach through NH HSEM's Field Services Section, The Ready Chinook Program for school aged children, and exhibits at conferences and workshops in an effort to educate the State in regards to preparedness, response, recovery and mitigation.	**Ongoing**	Multi-Agency	All Hazards	In-Kind	
41	30	NH HSEM will continue to work with the States Interagency Hazard Mitigation Team (IHMT) to prioritize and select projects which are cost beneficial and address the State's mitigation goals and objectives.	**Ongoing**	NH HSEM / IHMT	natural hazards	FMA, PDM, and HMGP	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
42	30	Increase understanding about flood risks and related impacts at the confluence where freshwater and tidal waters meet in estuarine systems, from wave action, and from changing sediment dynamics	**New**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding	In-Kind, NH Coastal Resilience Grants	
43	30	Continue to develop and maintain GIS layers as a multi-agency collaborative effort to capture data, including but not limited to: • NH DES-NHGS: Stream Crossing Initiative geodatabase. • NH DNCR-DHR: Sensitive natural and cultural resources and historical and archeological properties, and incorporation of archeological site data in the new Electronic Mapping and Management Information Tool (EMMIT) and promote use by municipalities, local heritage commissions, historical societies, and preservation professionals. • NH DNCR-DFL: LANDFIRE data layers (used to determine statistical probabilities of wildland fires). • NH DES Coastal Program: Coastal hazards (maximum flooding extent, nuisance flooding extent, etc.), locations of natural and manmade protective systems and barriers (salt marshes, seawalls, etc.), ongoing study locations, and others. Data collected in partnership with NH Fish and Game, UNH Sea Grant, and GRANIT. • NH HSEM: Maintain Hazard Mitigation Assistance (HMA)Program funded project layer.	**Ongoing**	DNCR-DHR / NHDES / NH HSEM	All Hazards	In-Kind, FMA, PDM, and HMGP CDC, EMPG	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
44	30	NH HSEM and DPHS will continue to co-host the Annual Emergency Preparedness Conference, which includes the promotion and education of mitigation.	**Ongoing**	NH HSEM / DPHS	All Hazards	In-Kind	
45	30	NH DNCR-DHR will continue its State Conservation Rescue Archeology Program (SCRAP), which is the recruitment and training field survey teams to expedite historical site reviews in an emergency.	**Ongoing**	NH DNCR-DHR	All Hazards	In-Kind	
46	30	NH DNCR-DHR will continue to complete and maintain a statewide assessment of deficiencies in survey data (done by town, but phase by county if necessary)	**Ongoing**	NH DNCR-DHR	Natural Hazards	In-Kind, NH Coastal Resilience Grants	
47	30	Recommend a comprehensive planning and zoning policy such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion.	**Ongoing**	NH CAW / NHDES	Coastal Flooding / Inland Flooding	FMA, PDM, and HMGP	
48	30	Disseminate information with respect to the availability of the Hazard Mitigation Assistance (HMA) Programs, including emailed notifications, requests for Letters of Intent (LOIs) to eligible applicants, and by conducting applicant briefings as to the existence and status of funding and related grant funding requirements.	**Ongoing**	NH HSEM	Natural Hazards	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
49	30	The State's Historic Preservation Officer (SHPO) and the NH DNCR-DHR will continue to inventory, catalogue and assess the State's important Archeological and Historical properties (including buildings, dams, bridges etc.).	**Ongoing**	NH DNCR-DHR / NH HSEM	All Hazards	In-Kind, FMA, PDM, and HMGP	
50	29	Provide planning and related technical resources to facilitate the enhancement of Disaster Response and Recovery Plans to include Hazard Mitigation initiatives.	**Ongoing**	NH HSEM	All Hazards	In-Kind, USGS	
51	29	Sustain the enhancement of the gauging network as recommended by the USGS and NHDES-WD.	**Ongoing**	NHDES	Inland and Coastal Flooding	In-Kind	
52	29	Sustain the development of public/private partnerships in the planning for post-event recovery to promote a more resilient State.	**Ongoing**	NH HSEM / NHDES	All Hazards	EMPG	
53	29	Sustain the implementation of the required annual State employee cyber training.	**New**	Multi-Agency	Cyber Event	In-Kind	
54	29	NH DNCR-DHR, including the State's Historic Preservation Officer (SHPO), will continue their efforts to improve the protection of important historical properties against fire, vandalism, and flooding, among other hazards.	**Ongoing**	NH DNCR-DHR	All Hazards	In-Kind, EMPG	
55	29	NH IAC will conduct vulnerability assessments and maintain a database for State critical infrastructure.	**Ongoing**	NH IAC, DHS	All Hazards	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
56	29	Continue to develop and utilize within the Communicable Disease Control Section (CDCS) standard operating procedures for each reportable disease.	**Ongoing**	NH DHHS	Infectious Diseases	NH Coastal Resilience Grants, FMA, PDM, and HMGP	
57	29	Provide technical assistance through funding and staff support to coastal communities to enhance current and future coastal hazard mitigation planning and activities	**Ongoing**	NHDES - Coastal Program	Coastal Flooding / Inland Flooding	In-Kind	
58	29	Continue the development of local and regional river corridor stewardship programs such as the Rivers Management and Protection Program.	**Ongoing**	Multi-agency	Inland Flooding	In-Kind	
59	28	NH HSEM will make the NH State Multi-Hazard Mitigation Plan Update 2018 available online as an interactive PDF through the HSEM Resource Center and other applicable State websites.	**Ongoing**	NH HSEM	All Hazards	In-Kind	
60	28	Sustain the dissemination of emergency information through the statewide 211 system.	**Ongoing**	NH HSEM / Granite United Way	All Hazards	In-Kind	
61	28	Enhance syndromic surveillance in schools	**Ongoing**	NH DHHS	Infectious Diseases	In-Kind	
62	28	Maintain collection and distribution of accurate weather and roadway information through the use of existing Road Weather Information System (RWIS). Enhance existing system through deployment of additional stations.	**Ongoing**	NH DOT	Natural Hazards	In-Kind	

Action Number	Prioritization Score	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Comments
63	28	NHDOT will continue providing transfer switches on construction of new signals on projects.	**Ongoing**	NH DOT	All Hazards	In-Kind, EMPG	
64	27	Receive and disseminate homeland security information from federal, state and local partners in accordance with annual federal information sharing requirements.	**Ongoing**	NH IAC	Terrorism/ Violence, Cyber, Mass Causality Incident	In-Kind, EMPG	
65	26	NH IAC will educate state and local public safety and health personnel on CIKR asset protection and assistance programs	**Ongoing**	NH IAC	All Hazards	In-Kind	
66	25	Explore and implement the digitization of records across the State and consider assessment of current location of documentation with respect to hazard vulnerabilities.	**New**	Multi-Agency	All Hazards	In-Kind	
67	25	Continue to expand the use of NH Electronic Disease Surveillance System (NH EDSS) to all investigating staff members at the local and state level.	**Ongoing**	NH DHHS	Infectious Diseases	In-Kind	
68	25	Maintain video surveillance at select Turnpike Toll Plazas, Welcome Centers, Rest Areas, Park-n-rides, Transit Centers, and other critical assets.	**Ongoing**	NH DOT	All Hazards	In-Kind	

Plan Implementation and Maintenance

Implementation and Monitoring

The SHMPC determined that the process for monitoring, evaluating, and updating the 2018 State Multi-Hazard Mitigation Plan was efficient and met the necessary criteria for the involved agencies. The Committee will review the process prior to the 2023 update and make appropriate changes based on national criteria at that time.

The implementation of the Plan shall continue to be an ongoing effort on the part of the NH HSEM Director, the SHMPC, and the SHMO. The SHMO shall be responsible for annual Plan maintenance as well as reporting suggested changes/additions to the SHMPC and the NH HSEM Director as appropriate and needed to ensure continuity with the Plan. Such reports will be incorporated into the NH HSEM Internal SHMP Working Group's agenda and conveyed to the NH HSEM Director.

The Plan shall be reviewed and evaluated following each declared/non-declared event, or at a minimum on an annual basis. The Plan will be updated formally every five years. The review will detail any adjustments that need to be made to the Plan to illustrate changes from across the State, such as updated maps or changes in priorities from within the State's mitigation strategy. The State will review and evaluate in accordance with FEMA's State Mitigation Plan Review Guide (2015)[235]. The process for the annual review of the Plan is the responsibility of the SHMO and the SHMPC with all plan contributors being included either in group or individual meetings to ensure consistency and continuity. Recommendations derived from the meetings will be evaluated and forwarded by the SHMO to the NH HSEM Internal SHMP Working Group for consideration and comment. More specifically, the NH HSEM Internal SHMP Working Group will:

- Review the Hazard Identification and Risk Assessment, to reflect new historical information for natural, human-caused hazards, and technological hazards
- Review the Hazard Identification and Risk Assessment, to incorporate new data collected on State and local critical facilities, infrastructure, and population
- Review the Capability Assessment, to integrate new programs, policies, initiatives, and funding capabilities at the local, State and Federal level
- Incorporate a summary of the development of local mitigation plans in the Coordination of Local Mitigation Planning
- Examine the progress and effectiveness of mitigation projects completed. Determine whether or not they meet the goals of the State's Mitigation Plan, and if not, whether or not the State's mitigation strategy should be modified

Recommendations for Plan amendment shall be forwarded to the NH HSEM Director for consideration and Plan amendment approval.

Any Section of the 409 Plan that is recommended for amendment by the NH HSEM Director shall be forwarded to the FEMA Regional Office Hazard Mitigation Division staff for review and final adoption in accordance with 44 CFR, Subpart M.

235 https://www.fema.gov/media-library-data/1425915308555-aba3a873bc5f1140f7320d1ebebd18c6/State_Mitigation_Plan_Review_Guide_2015.pdf

Plan Maintenance

The SHMO and the SHMPC shall assure maintenance of the Plan and shall consider and approve projects that are submitted for HMGP, FMA, and PDM funding in accordance with the Plan's Goals and Objectives.

The SHMO will contact the following participants via email, surveys, and social media and will consider their comments for inclusion in annual updates of the Plan:

- State Hazard Mitigation Planning Committee
- Regional Planning Commissions
- Representatives of local jurisdictions
- Private/Non-profit organizations
- Members of the general public

Continuing Relevancy of Goals and Objectives

The SHMO and the SHMPC shall continually monitor the relevancy of the Plan's stated Goals and Objectives. They will take this step when considering any and all mitigation measures.

Effectiveness of Mitigation Strategies and Measures

The SHMO and the SHMPC shall work cooperatively to identify and evaluate the effectiveness of all existing Hazard Mitigation measures, and assess and adjust the mitigation strategy accordingly.

Unless the NH HSEM Director and/or the SHMPC identify an adjustment as an emergency measure, adjustments requiring a modification to the State's Plan shall follow the procedure for Plan amendment. In all cases where an apparent departure from the Plan may have been initiated, at the earliest practical opportunity, or within 30 days (whichever is less), the SHMO shall prepare and report the emergency measures and amendments undertaken, and submit the Plan amendment to FEMA for amendment approval.

Monitoring of Mitigation Activities

At the time of the 2018 Plan update, SHMPC determined that the current process for monitoring the progress of mitigation activities was efficient and worked well for all agencies involved. It was determined that no changes were necessary at that time, but the process would be reviewed again prior to the 2023 Plan update. Multiple actions were completed since the 2013 Plan Update and either removed or marked as ongoing for the 2018 Plan. Those actions that have been determined to be a continuous action were reviewed for incorporation in the 2018 Plan update.

Any HMGP, FMA, and PDM -funded projects will include the closeout procedures as identified in the Hazard Mitigation Administrative Plan 2017. The SHMO will monitor all HMGP, FMA, and PDM, project closeouts. At a minimum, the following will occur for project closeouts:

- The subrecipient shall submit closeout information in the form of a final report on work done, expenditures, and other costs.
- Project closeouts will be noted in the project files.
- Final payments shall be made along with a closeout letter.

State agencies that are identified in the Mitigation Action Plan, or are contributing to any of the mitigation measures identified in the Mitigation Strategy chapter of the Plan, will submit Mitigation

Action Progress Report Form *(Appendix B)* on an annual basis. The SHMO will track progress of actions and projects identified in the State Hazard Mitigation Plan by meeting and maintaining contact with members of the SHMPC.

Future Enhancements

The SHMPC will review the need for improvements for the 2023 Plan. Funding sources considered for improvements will need to be reviewed and approved by the NH HSEM Director, as well as Governor and Executive Council. The 2018 Plan update was funded and written by NH HSEM. The SHMO and the SHMPC shall endeavor to develop appropriate and cost effective Hazard Mitigation strategies as may be consistent with the achievement of the stated goals and objectives.

The SHMO and the SHMPC will continue to study the potential impacts of such hazard events that may affect the State's citizens and guests as well as its infrastructure, critical facilities, aviation and navigation facilities, agriculture, aquaculture, forests, ecology, economy (e.g. tourism industry, forest products, etc.), historical resources and quality of life and endeavor to develop cost effective strategies to mitigate losses associated with these events.

Appendices

A. **Acronym List**
B. **Mitigation Action Progress Report Form**
C. **2013 State Multi-Hazard Mitigation Plan – Mitigation Action Plan Status**
D. **SHMPC Prioritization Criteria Worksheet – 2018 Mitigation Actions**
E. **County History (Excerpt from 2013 Plan)**

A - Acronym List

BFE – Base Flood Elevation
CAW – Coastal Adaptation Workgroup
CIKR – Critical Infrastructure Key Resources
CRS – Community Rating System
CWPP – Community Wildfire Protection Program
DHS – Department of Homeland Security
EMD – Emergency Management Director
FEMA - Federal Emergency Management Agency
FMA – Flood Mitigation Assistance Program
GETS – Government Emergency Telecommunications Service
HMGP – Hazard Mitigation Grant Program
NCICS – North Carolina Institute for Climate Studies
NFIP – National Flood Insurance Program
NHC – National Hurricane Center
NHDES – New Hampshire Department of Environmental Services
NHCRHC – New Hampshire Coastal Risk and Hazards Commission
NHFMO – New Hampshire Fire Marshal's Office
NHGS – New Hampshire Geological Survey
NHMS – New Hampshire Motor Speedway
NHS – National Highway System
NHSP – New Hampshire State Police
NIMS – National Incident Management System
NRF – National Response Framework
NH CIC – New Hampshire Cyber Integration Center
NH DHHS – New Hampshire Department of Health and Human Services
NH DHR – New Hampshire Division of Historical Resources
NH DNCR – New Hampshire Department of Natural and Cultural Resources
NH DOT – New Hampshire Department of Transportation
NH HSEM – New Hampshire Homeland Security and Emergency Management
NH IAC – New Hampshire Information and Analysis Center
NH OSI – New Hampshire Office of Strategic Initiatives
NH PHL – New Hampshire Public Health Laboratories
NH RAD –
NOAA – National Oceanic and Atmospheric Administration
NWS – National Weather Service
PAS – Program Administration by States
PDM – Pre-Disaster Mitigation Program
PSA – Public Service Announcement
PUC – Public Utilities Commission
SEOP – State Emergency Operations Plan
SHMPC – State Hazard Mitigation Planning Committee
SHMP – State Hazard Mitigation Plan
SHMO – State Hazard Mitigation Office
STAP – Science and Technical Advisory Panel

New Hampshire Department of Safety
Division of Homeland Security and Emergency Management
State Hazard Mitigation Plan

Mitigation Action Progress Report Form

Project Information			
Action/Project Title			
Progress Report Period	From:	To:	
Project Status	☐ Project Completed	☐ Project Cancelled	
	☐ Project on Schedule	Anticipated Completion Date:	
	☐ Project Delayed		
	Explain:		

1. What was accomplished for this project during this reporting period?

2. What obstacles, problems, or delays did the project encounter?

3. If uncompleted, is this project still relevant? Should the project be changed or revised?

4. Other Comments

Contact Information			
Responsible Agency			
Contact Name			
Contact Phone		Contact Email:	

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C - 2013 State Multi-Hazard Mitigation Plan – Mitigation Action Plan Status

2013 Plan Mitigation Action	Status	Comments
Assist in the development of Fire Mutual Aid Task Force capabilities.	**Completed**	Action status agreed upon by stakeholders at May update meeting.
Thoroughly research and analyze existing information on coastal hazards, statutory authorities and plan strategies and synthesize the findings in a report.	**Completed**	Coastal Risk and Hazard Commission Report was written in 2013. Action status agreed upon by stakeholders at May update meeting.
Upgrade hardware/software to digitize all remaining records, either locational data or full records.	**Completed**	Action was finalized in 2018 for NH DNCR-DHR.
GIS layer digitizing all known area surveys (project area, historic district area, town-wide area, and National Register district), needs to be done.	**Completed**	Action was finalized in 2018 for NH DNCR-DHR.
Connect every NH hospital to the Automated Hospital Emergency Department Data (AHEDD) system.	**Completed**	Action status agreed upon by stakeholders at May update meeting.
Organize and train Road Agents, EMDs and "Skywarn" etc. volunteers in affected areas in ice monitoring activities that will enhance the NH-CRREL database.	**Completed and Ongoing**	Silver Jackets Team executed Ice Jam Outreach Project in the fall of 2017. Will continue to provide outreach.
Sustain the Emergency Alert System as necessary	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.
Development of a tips line for the reporting of homeland security concerns	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.
Maintain the statewide Reverse 911 system for the dissemination of hazardous situations and emergency events.	**Ongoing**	E911 continues to maintain the emergency notification system.
The SHMO will continue to work with the HSEM Field Representatives to make direct outreach to the State's EMDs and other community officials with Hazard Mitigation workshops.	**Ongoing**	Revising new action to state "The SHMO will provide State agencies, local communities, Regional Planning Commissions, private non-profit, and private entities with applicable hazard mitigation outreach regarding the State's initiatives and available resources".

2013 Plan Mitigation Action	Status	Comments
The State will closely support local communities, with assistance from the Regional Planning Commissions, in the creation of local and Regional Mitigation Plans.	**Ongoing**	Revising new action to state "The State will closely support local communities, contractors, and Regional Planning Commissions in the creation of Local Hazard Mitigation Plans."
Sustain the New Hampshire Department of Environmental Services and Water Division in the implementation of the State's Drought Management Plan.	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.
Support DRED with the establishment of Fire wise communities in those areas of the state identified as high-risk for wildland fire.	**Ongoing**	Revising new action to state "The Department of Natural and Cultural Resources will establish Firewise communities in those areas of the state identified as high risk for wildland fire".
Sustain the enhancement of the gauging network as recommended by the USGS and NHDES-WRD.	**Ongoing**	Revising new action to state "Sustain the enhancement of the gauging network as recommended by the USGS and NHDES-WD.".
The SHMO shall work with the HSEM Field Representatives, local EMDs and other interested regional and local entities to develop lists of public and private facilities considered “Essential” to regional and local interests during/after events.	**Ongoing**	Revising new action to state "The SHMO will work with local communities, contractors, and Regional Planning Commissions to develop and maintain lists of public and private facilities considered essential to regional and local interests during/after events within their Local Hazard Mitigation Plans."
Continue to work with the State's Hazard Mitigation Team to select projects which are cost beneficial and address the State's Hazard Mitigation Goals and Objectives.	**Ongoing**	Revising new action to state "HSEM will continue to work with the States Interagency Hazard Mitigation Team (IHMT) to prioritize and select projects which are cost beneficial and address the State's mitigation goals and objectives".
Sustain the development of standards to locate new construction of WWTPs above the 500 year Flood level	**Ongoing**	Revising new action to state "Incorporate 500 year flood plain threshold for new construction of drinking water and wastewater facilities in accordance with NEIWPCC’s TR-16 Guides for the Design of Wastewater Treatment Works and other similar documents (Revised 2011 Edition)."
Assist Homeland Security and Emergency Management in the development of increased standards for those facilities that maybe at risk from natural and Human-caused hazard	**Ongoing**	Revising new action to state "Promote and educate in the development of increased standards for those facilities that maybe at risk from natural and Human-caused hazard."

2013 Plan Mitigation Action	Status	Comments
Assist the Dam Bureau in the execution of dam safety inspections and enforcement programs as needed	**Ongoing**	Revising new action to state "The Dam Bureau will continue to execute dam safety inspections and enforcement programs as needed".
Sustain NHDOT and UNH - TTC - T2 Program in the development of road design construction, storm water and road drainage standards, including culvert and bridge sizing.	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.
Encourage the development of local and regional river corridor stewardship programs that address the maintenance of storm water runoff structures and systems.	**Ongoing**	Revising new action to state "Continue the development of local and regional river corridor stewardship programs such as the Rivers Management and Protection Program."
Support the Department of Transportation (NH DOT) to conduct vulnerability assessments on the 24 critical bridges throughout the state	**Ongoing**	Revising new action to state "NH DOT to conduct vulnerability assessments on the 24 critical bridges throughout the state."
Support the NHDOT in the identification, analysis, design solutions and construction of repeated areas of road closures for the various types of hazards	**Ongoing**	Revising new action to state "NH DOT to identify, analyze, and create design solutions for repeated areas of road closures."
Conduct vulnerability assessments on state critical infrastructure	**Ongoing**	Revising new action to state "NH IAC will conduct vulnerability assessments and maintain a database for State critical infrastructure."
Train state and local public safety and health personnel on CIKR asset protection and assistance programs	**Ongoing**	Revising new action to state "NH IAC will educate state and local public safety and health personnel on CIKR asset protection and assistance programs."
Provide planning and related technical resources to facilitate the enhancement of Disaster Response and Recovery Plans to include Hazard Mitigation initiatives.	**Ongoing**	State will continue to update State Emergency Operations Plan and Recovery Annex. Action status agreed upon by stakeholders at May update meeting.
Sustain the development of public/private partnerships in the planning for post-event recovery.	**Ongoing**	Revising new action to state "Sustain the development of public/private partnerships in the planning for post-event recovery to promote a more resilient State."
HSEM will support the annual All-Hazard Public and Private Sector Emergency Preparedness Conference	**Ongoing**	Revising new action to state "NH HSEM and DPHS will continue to co-host the Annual Emergency Preparedness Conference, which includes the promotion and education of mitigation."
Provide generators at selected state-owned fuel locations to provide fuel to emergency vehicles during an extended power outage.	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.

2013 Plan Mitigation Action	Status	Comments
Provide generators for selected major intersections of state and local roads as determined by NHDOT and affected city/town staffs to provide electricity to power the traffic signal systems during an extended power outage	**Ongoing**	Revising new action to state "NHDOT is providing Transfer switches on construction of new signals on projects, this would allow the town to bring in a portable generator (of certain specifications) during a prolonged outage event to power the lights at these intersections. For certain priority intersections as requested by Towns, NHDOT will install transfer switches on existing traffic signal systems, again the town is always required to provide the generator during outages."
Receive and disseminate as appropriate homeland security information from federal, state and local partners	**Ongoing**	Revising new action to state "Receive and disseminate homeland security information from federal, state and local partners in accordance with annual federal information sharing requirements."
Assist the State's Historic Preservation (SHPO) Officer and the NH Division of Historical Resources (NHDHR) in efforts to inventory, catalogue and assess the State's important Archeological and Historical properties (including buildings, dams, bridges etc.)	**Ongoing**	Revising new action to state "The State's Historic Preservation Officer (SHPO) and the NH DNCR-DHR will continue to inventory, catalogue and assess the State's important Archeological and Historical properties (including buildings, dams, bridges etc.)."
Assist NH Division of Historical Resources (NHDHR) in the recruitment and training Emergency Field Survey Teams to expedite Historical site reviews in an emergency.	**Ongoing**	Revising new action to state "NH DNCR-DHR will continue its State Conservation Rescue Archeology Program (SCRAP), which is the recruitment and training field survey teams to expedite historical site reviews in an emergency."
Fund cost –effective Mitigation Projects through available federal grants and local cost share (HMGP, PDMc, FMA, RFC, SRL).	**Ongoing**	Revising new action to state "Fund cost –effective Mitigation Projects through available federal grants and local cost share (HMGP, PDM, FMA)."
Encourage and assist communities with the mitigation of repetitive loss properties acquisition & demolition, relocation or elevation (funding through HMGP, PDMc, FMA, RFC, SRL)	**Ongoing**	Revising new action to state "Encourage and assist communities with the mitigation of repetitive loss properties acquisition & demolition, relocation or elevation (funding through HMGP, PDM, FMA)."

2013 Plan Mitigation Action	Status	Comments
Produce copies of this Plan and distribute these to all members of the State Hazard Mitigation Team, State Point Of Contact's (POC's) of the relevant Lead and Support Agencies, Regional Planning Commissions and other interested private parties, to facilitate Hazard Mitigation planning and implementation.	**Ongoing**	Revising new action to state "NH HSEM will make the NH State Multi-Hazard Mitigation Plan Update 2018 available online as an interactive PDF through the HSEM Resource Center and other applicable State websites."
Increase funding and resources for land acquisition, conservation planning, land management programs, and land stewardship in areas at risk of loss or degradation due to sea level rise.	**Ongoing**	Revising new action to state "Promote funding and resources for land acquisition, conservation planning, land management programs, and land stewardship in areas at risk of loss or degradation due to sea level rise."
Establish a comprehensive planning and zoning policy such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion	**Ongoing**	Revising new action to state "Recommend a comprehensive planning and zoning policy such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion."
Establish new street grade and building first floor elevation requirements that exceed current Town, State, and FEMA standards.	**Ongoing**	Revising new action to state "Encourage communities to adopt floodplain management regulations that exceed the minimum NFIP requirements, incorporating higher standards (e.g. freeboard, setback and compensatory storage requirements) that will improve local flood resilience."
Support the installation of regionally and locally significant staff gauges and other such monitoring equipment as determined to be necessary by local EMDs, Road Agents, etc.	**Ongoing**	Revising new action to state "Promote the installation of regionally and locally significant staff gauges, tidal gauges, and other such monitoring equipment as determined to be necessary by local EMDs, Road Agents, etc."
State-wide assessment of deficiencies in survey data (done by town, but phase by county if necessary).	**Ongoing**	Revising new action to state "NH DNCR-DHR will continue to complete and maintain a statewide assessment of deficiencies in survey data (done by town, but phase by county if necessary)."

2013 Plan Mitigation Action	Status	Comments
Support the development of information dissemination opportunities with broadcast and cablecast media during times of potential hazard conditions as a support agency	**Ongoing**	Revising new action to state "State agencies will continue the collaborative development of information dissemination opportunities via many outreach methods, including but not limited to: broadcast media, social media platforms, ReadyNH.gov, Public Service Announcements (run on closed cable networks and broadcast media), printed materials, direct outreach through NH HSEM's Field Services Section, The Ready Chinook Program for school aged children, and exhibits at conferences and workshops in an effort to educate the State in regards to preparedness, response, recovery and mitigation.
Sustain the dissemination of emergency information through the statewide 211 system and the Ready NH website	**Ongoing**	Revising new action to state "Sustain the dissemination of emergency information through the statewide 211 system."
Disseminate information with respect to the availability of HMGP funding including the posting of public notices, posting direct mail Notices of Interest to eligible applicants and/or by conducting public information briefings as to the existence and status of HMGP funding and related grant funding requirements.	**Ongoing**	Revising new action to state "Disseminate information with respect to the availability of the Hazard Mitigation Assistance (HMA) Programs, including emailed notifications, requests for Letters of Intent (LOIs) to eligible applicants, and by conducting applicant briefings as to the existence and status of funding and related grant funding requirements.

2013 Plan Mitigation Action	Status	Comments
Develop a strategy for Mapping existing sensitive cultural resources as may be impacted by the various hazard types in a GIS format useful in Hazard Mitigation project approval and for use in future Disaster Field Offices.	**Ongoing**	Revising new action to state "Continue to develop and maintain GIS layers as a muti-agency collaborative effort to capture data, including but not limited to: • NH DES: Stream Crossing Initiative geodatabase. • NH DNCR-DHR: Sensitive natural and cultural resources and historical and archeological properties, and incorporation of archeological site data in the new Electronic Mapping and Management Information Tool (EMMIT) and promote use by municipalities, local heritage commissions, historical societies, and preservation professionals. • NH DNCR-DFL: LANDFIRE data layers (used to determine statistical probabilities of wildland fires). • NH DES Coastal Program: Coastal hazards (maximum flooding extent, nuisance flooding extent, etc.), locations of natural and manmade protective systems and barriers (salt marshes, seawalls, etc.), ongoing study locations, and others. Data collected in partnership with NH Fish and Game, UNH Sea Grant, and GRANIT. • NH HSEM: Maintain Hazard Mitigation Assistance (HMA)Program funded project layer.
Assist the State's Historic Preservation Officer (SHPO) and the NH Division of Historical Resources (NHDHR) in efforts to improve the fire protection of those important historical properties.	**Ongoing**	Revising new action to state "NH DNCR-DHR, including the State's Historic Preservation Officer (SHPO), will continue their efforts to improve the protection of important historical properties against fire, vandalism, and flooding, among other hazards."
Provide necessary support to the NHDES-Coastal Program in its Flood Hazard Mitigation activities and in the preservation of the State's marine and adjacent environments	**Ongoing**	Revising action to state, "Provide technical assistance through funding and staff support to coastal communities to enhance current and future coastal hazard mitigation planning and activities."
Sustain the NHDES Coastal Program's participation and support of the Coastal Adaptation Workgroup to address hazard and mitigation needs relative to state and community infrastructure.	**Ongoing**	Revising action to state, "Utilize collaborative partnerships, including the NH Coastal Adaptation Workgroup and the Upper Valley Adaptation Workgroup, to conduct outreach, technical assistance and assessments on current and future flood hazard mitigation".

2013 Plan Mitigation Action	Status	Comments
Utilize and/or establish base information that is provided by an agency that studies sea level rise in the region, striving for consistent use of information and models that are used within the New England region. This is important for keeping information constant, reliable and enables the Town to set benchmarks for implementation as well as tracking progress.	**Ongoing**	Revising action to state, "Update storm surge, sea-level rise, precipitation, and other relevant projections recommended in the Coastal Risk and Hazards Commission 2014 report "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Paste and Projected Trends" at least every 5 years, pursuant to Chaptered Law 121."
Enhance syndromic surveillance in schools	**Ongoing**	School surveillance is constantly monitored by NH DHHS Infectious Disease Control. Data is submitted by schools on a volunteer basis and analyzed for base line and trends.
Develop and utilize within the Communicable Disease Control Section (CDCS) standard operating procedures for each reportable disease.	**Ongoing**	Revise to state, "Continue to develop and utilize within the Communicable Disease Control Section (CDCS) standard operating procedures for each reportable disease."
Expand the use of NH Electronic Disease Surveillance System (NH EDSS) to all investigating staff members at the local and state level.	**Ongoing**	Revise to state, "Continue to expand the use of NH Electronic Disease Surveillance System (NH EDSS) to all investigating staff members at the local and state level."
Evaluate the impacts of salt water intrusion into all aquifers that support the local and regional population.	**Ongoing**	Revising action to state, "Evaluate the impacts of saltwater intrusion and changing groundwater table elevations as a result of sea-level rise and implications for water, waste, and asset/infrastructure management."
Using materials supplied by National Fire Protection Association (NFPA) and others, the State will utilize and develop public information materials and for distribution to appropriate State Agencies, Regional Planning Committees and Local Planning Committees. Additionally, the NHSFMO will review and develop (as necessary) Public Service Announcements to alert interested parties to the existence of Fire, life safety and Hazardous Materials risks.	**Ongoing**	Action status agreed upon by stakeholders at May update meeting.

2013 Plan Mitigation Action	Status	Comments
Support the New Hampshire Department of Resources and Economic Development in the implementation of the State's Forest Fire Plan and other plans and authorities toward the development of cost effective wild land fire hazard mitigation measures	**Ongoing**	Revising new action to state "The Department of Natural and Cultural Resources will continue to assist in the development Community Wildfire Protection Plans (CWPP) and other plans and authorities toward the development of cost effective wildland fire hazard mitigation measures in accordance with the State's Forest Fire Protection Plan".
Support the NHDOT to install video surveillance at all Turnpike Toll Plazas, Welcome Centers, Rest Areas, Park-n-rides, Transit Centers, and other critical assets	**Ongoing**	Revising new action to state "Maintain video surveillance at select Turnpike Toll Plazas, Welcome Centers, Rest Areas, Park-n-rides, Transit Centers, and other critical assets."
Support the NHDOT in the collection and distribution of accurate weather and roadway information through the use of existing Rural Weather Information Stations (RWIS) and with additional stations planned throughout the State **ROGER TO FOLLOW UP**	**Ongoing**	Revising new action to state "Maintain collection and distribution of accurate weather and roadway information through the use of existing Road Weather Information System (RWIS). Enhance existing system through deployment of additional stations."
Incorporate projections of sea level rise in current and future capital infrastructure projects. Assessments should assume a 1.5 feet sea level rise for the year 2010 and at least a 2 to 5 feet sea level rise for the year 2100.	**Ongoing**	Revising action to state, "Incorporate projected sea-level rise, storm surge, and precipitation as well as associated changes in flood levels, currents, groundwater tables, stormwater runoff, and other related impacts into capital improvement projects, permitting, and other state actions."
Provide for training in Floodplain Management and the development of local policies and procedures which may facilitate responsible use of designated floodplain areas.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Complete building type to the Inventory of State-Owned Critical Facilities table in Chapter IV.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Disseminate results of climate change studies for the purpose of better floodplain planning and changing infrastructure standards (i.e.. Recommendations on culvert sizing and storm water volumes).	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Support studies which examine changing hydrology in rivers due to altered precipitation patterns and watershed development.	**Deleted**	Conducted upon request. Action status agreed upon by stakeholders at May update meeting.

2013 Plan Mitigation Action	Status	Comments
Utilizing information received from state and local agencies develop a list of critical support services and facilities.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Determine annual information requirements and priorities in regards to NH IAC providing situational awareness to stakeholders through an integrated, multi-discipline, information sharing network that will collect, analyze and disseminate accurate and timely information in order to provide state and local leadership with actionable information to protect the citizens and the critical infrastructure of New Hampshire.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain the protocol for post-disaster data collection as to economic direct and indirect losses from events by type	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Support the inclusion of planning for economic Hazard Mitigation and recovery in local Hazard Mitigation Plans.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Train local fire and hazardous materials teams on the rapid deployment of remediation measures with regards to Fire and HazMat.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Assist in local planning enterprises toward the identification and prioritization of cost-effective relocation	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Notify all eligible applicants of available hazard mitigation project grant programs for local mitigation projects , including fund through the (HMGP, PDMc, FMA, RFC, SRL) Programs, as well as other mitigation opportunities.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Work with Communities to implement cost effective, environmentally sound, and technically feasible mitigation projects to severe repetitive loss properties.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.

2013 Plan Mitigation Action	Status	Comments
The State will review and develop (as necessary) Public Service Announcements to alert interested parties as to the existence and availability of these products and publish such material to the worldwide web as resources allow.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
NH HSEM will continue to sustain the CEMPS initiative through the Emergency Management Planning Grant Program.	**Deleted**	Action status agreed upon by stakeholders at May update meeting. Program no longer exists and has been integrated into the School Readiness Program.
Using materials such as the NESEC video, New England's Next Earthquake and the publication from the State of Maine Emergency Management Office, When Rivers Rise as models; the State will develop public information materials for distribution to appropriate State Agencies, Regional Planning Commissions, communities and interested parties	**Deleted**	Outdated publication that is no longer being produced.
Encourage the development of local Flood Reduction Programs.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
The NHSFMO will review and develop (as necessary) Public Service Announcements to alert interested parties to the existence of Fire, life safety and Hazardous Materials risks.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain the Hurricane Tracking Chart Program and related initiatives to help raise the awareness in the general population of the State's Vulnerability to significant hurricane events.	**Deleted**	No longer passing out physical charts for hurricane awareness/vulnerability.
The State will maintain its Hazard Mitigation Plan by addressing Hazard Identification, Vulnerability Assessment, Risk Analysis and assess its capabilities to mitigate the effects of such hazards. (Funded by HSEM through annual FEMA Grants)	**Deleted**	This action is inherent in the FEMA requirements of the State Hazard Mitigation Plan.

2013 Plan Mitigation Action	Status	Comments
OEP NFIP staff shall regularly conduct CAV's, during which Hazard Mitigation is discussed along with NFIP issues.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
The SHMO shall address civic, professional and other groups interested in Hazard Mitigation, specifically regarding the State's initiatives and available resources.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain the production and distribution of educational materials as necessary to alert the public of the risk and the appropriate preparedness and mitigation actions.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain the New Hampshire Department of Resources and Economic Development in the implementation of the State's Forest Fire Plan and related Plans and authorities toward the development of cost-effective Wildland Fire Hazard Mitigation measures.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain the water resource planning initiative being implemented by RC&D to provide rural communities with water supplies available for fire suppression.	**Deleted**	Upon discussion at the May stakeholder meeting, it was determined, based on the attendees' best knowledge, that the Department of Natural and Cultural Resources no longer implements the water resource planning initiative.
Support DRED in the development and implementation of Community Wildfire Protection Plans (CWPP's) aimed at reducing the losses of resources from wildland fires	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Assist HSEM in the design of hazard mitigation measures.	**Deleted**	Unable to determine the intent of this action.
Assist the Dam Bureau in the cost-effective upgrade of State-owned dams for the purpose of optimizing operational controls and the mitigation of the effects of Floods.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Consider the development of such programs above by employing the use of volunteers such as Boy/Girl Scouts, watershed groups, environmentally conscious groups, prisoners, etc. to assist in river corridor maintenance programs	**Deleted**	Action status agreed upon by stakeholders at May update meeting.

2013 Plan Mitigation Action	Status	Comments
Maintain database of state critical infrastructure	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Facilitate the review and development of existing Emergency Operation Plans for potential enhancement with respect to Natural and Human-caused Hazards Mitigation initiatives.	**Deleted**	This action item was deleted as it is considered a FEMA requirement for Local Hazard Mitigation Plans. Action status agreed upon by stakeholders at May update meeting.
Assist local Fire Departments, Hazardous Materials Teams, EMS providers and Law Enforcement in developing and improving the local Operations plans.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Develop and train the Regional Hazardous Materials Teams within the State	**Deleted**	NH Fire Marshal's Office doesn't train the Regional Hazardous Materials Teams in the State. Fire Standards and Training and Emergency Medical Services (FSTEMS) provides this training. Teams are in charge of their own training and records. Action status agreed upon by stakeholders at May update meeting.
Sponsor Disaster Response Capability training exercises for State and local officials.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Sustain Incident Stress Debriefing training workshops for responders and citizens and train debriefers to assist in post-event scenarios.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Provide for training in communications protocols for local and regional Emergency Responders.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Continue to support Homeland Security Exercise Evaluation Program exercise activities for emergency response capabilities training	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Assist State and local officials in developing individual and collective Recovery capability by providing resources and opportunities regarding participation in training exercises.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Sustain strategies, plans and infrastructure to accommodate event debris management in an environmentally sound manner.	**Deleted**	New action created that includes the consideration of providing education and outreach for mitigation strategies pre-event debris management.

2013 Plan Mitigation Action	Status	Comments
Develop a comprehensive Radiological Emergency-Response Containment Program.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Develop and implement a Monitoring Point Website	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Assist HSEM in facilitating awareness and acceptance of Hazard Mitigation Planning and the propagation of responsible Hazard Mitigation initiatives.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Identify and catalogue categories of potential loss from natural hazards.	**Deleted**	Unable to determine the intent of this action.
Assist in the development of potential loss areas utilizing information provided by local, state and federal entities.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Assist in the development of Hazard Mitigation Plans in selected communities	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Continue to process existing applications and assist with approved projects with respect to all open Disaster related accounts.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Continue to work with the State's Hazard Mitigation Team to select projects which are cost beneficial and address the State's Hazard Mitigation Goals and Objectives.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Revise the HMGP Administrative Plan with Technical Assistance from FEMA.	**Deleted**	Action removed as this is a federal requirement to receive funding through the Hazard Mitigation Grant Program (HMGP).
The State will continue to support the CEMPS initiative through the EMPG Program. (Funded by HSEM through annual FEMA Grants)	**Deleted**	Action status agreed upon by stakeholders at May update meeting. Program no longer exists and has been integrated into the School Readiness Program.
The NH HSEM will continue to refine the CEMPS curriculum so as to ensure relevancy with the most current and applicable information and mitigation techniques	**Deleted**	Action status agreed upon by stakeholders at May update meeting. Program no longer exists and has been integrated into the School Readiness Program.
The SHMO will continue to support Hazard Mitigation planning and projects statewide as are consistent with this Plan.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.

2013 Plan Mitigation Action	Status	Comments
Provide for workshops aimed at Dam Safety and maintenance.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Establish a uniform regional baseline in Hazard Mitigation Planning for existing and potential future climate change and sea level rise.	**Deleted**	Revised as a new mitigation action.
Define a protected or transition zone between existing and projected hazard areas and developed areas and prohibit incompatible land uses that would place these lands in the transition zone at risk of threat or degradation.	**Deleted**	The State does not have jurisdictional authority to implement this action. Action status agreed upon by stakeholders at May update meeting.
Support DES in Fluvial Studies of NH Watersheds to gain the best scientific data on reducing the effects of flooding in NH communities while maintaining environmentally sound solutions.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Support the New Hampshire Department of Resources and Economic Development in the implementation of the State's Forest Fire Plan and related Plans and authorities toward the development of cost effective Wildland Fire Hazard Mitigation measures.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
The State will closely support local communities, with assistance from the Regional Planning Commissions, in the creation of local and Regional Multi-Mitigation Plans.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Identify ideal NOAA Weather transmitter locations and alternates that will provide at least 90% signal reception to the State.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Complete assessment of mitigation funds currently being utilized within the State	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Provide materials to educate the public about the safest measures that should be taken outside of buildings during severe wind events.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.

2013 Plan Mitigation Action	Status	Comments
Establish integration between the NH State Fire Marshal's Office and HSEM for the dissemination of critical information	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with the previous mitigation action.
Assist HSEM with the development of hazard mitigation information for Fire and Hazardous Materials incidents.	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with the previous mitigation action.
Publish such relevant material to the HSEM and Ready NH websites as it may relate to Preparedness, Mitigation, Response and Recovery.	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with the previous mitigation action.
Provide for workshops in Hazard Mitigation aimed at Dam Safety and maintenance to municipal dam owners.	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with the previous mitigation action.
Share information with local and federal public and private agencies to minimize the impact from human-caused and natural disasters	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with a previous mitigation action.
Provide public safety and health leadership with situational awareness and strategic assessments related to natural and human-caused hazard events	**Deleted**	Unable to determine the intent of this action.
Include Flood Hazard Mitigation information going to cost-effective Flood Hazard Mitigation measures for private property in Non-Commercial Service Announcements.	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with a previous mitigation action.
Publish and distribute information brochures going to cost effective Mitigation measures and the availability of mitigation resources.	**Deleted**	In an effort to streamline the mitigation strategy, this outreach item has been combined with a previous mitigation action.
Support DRED in the use of GIS data layers to map and identify the high-risk areas of the state for potential wildland fires, including the use of LANDIS, a new software model for extrapolating large amounts of data into the future to determine statistical probabilities of wildland fires.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Create visualization tools for communities to better understand the impacts of coastal flooding on infrastructure.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Develop GIS data as it pertains to public safety and health events	**Deleted**	Unable to determine the intent of this action.

2013 Plan Mitigation Action	Status	Comments
Develop a strategy for mapping existing sensitive natural resources that may be impacted by the various hazard types in a GIS format that can be useful in Hazard Mitigation, project approval and for use in future DFOs.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Assist HSEM in the development of sensitive natural resources that may be impacted by various hazards utilizing information provided by NH Forest and Lands.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Conduct an analysis of the impact of prior natural and Human-caused disasters on the State's Historical and Archeological properties as well as the potential for future impacts to these resources from the hazards identified in this Plan.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Support NHDES Coastal Program and other organizations' efforts to develop adaptation strategies. This will include creating a web-based data and information portal about coastal hazards including visualization tools (such as browser-based maps providing access to hazards information), and developing mapping, studies and protection of natural systems (such as salt marshes) that provide natural protection against coastal flooding.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Develop adaptation strategies. To include creating a web based data and information portal about coastal hazards including visualization tools and developing mapping, studies and protection of natural systems that provide natural protection against coastal flooding.	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.
Assist with the retrofit of existing Waste Water Treatment Plants (WWTP) to withstand the 500 year flood event to the extent that such retrofits may be made cost effective	**Deleted**	In an effort to streamline the mitigation strategy, this item has been combined with a previous mitigation action.

2013 Plan Mitigation Action	Status	Comments
Provide planning assistance and technical resources to local communities so they can plan accordingly for evacuation due to common local hazards	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Complete building type to the Inventory of State-Owned Critical Facilities table in Chapter IV.	**Deleted**	This action item has been removed based upon the limited number of facilities in the State that meet federal Critical Infrastructure Sector criteria.
Better establish protocols and procedures for NH DHHS use of the HAN system including; Define essential public health capacity for HAN, Establish 2-way communication mechanisms for use in public health emergencies, Test response of NH DHHS.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Pilot a Countermeasure & Response Administration (CRA) solution for managing data in the event of a statewide response to an epidemic.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Develop and maintain the Food Emergency Response Plan to allow for the preparedness, active investigation, emergency response and recovery during a food emergency response occurring in the State of NH	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Provide ongoing technical support and information to other state agencies, local governments, the general public and the media concerning food safety issues during natural, technological or Human-caused disasters.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Investigate the need for food safety training pertinent to disaster situations for other state agencies and local governments.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Develop Emergency Action Plans for Retail Establishments during emergencies and distribute to food service establishments to self-inspecting communities	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Expedite the response of the Food Protection Section to disaster situations.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.

2013 Plan Mitigation Action	Status	Comments
Provide on-site inspections, when needed, to assess the effects of a disaster on the safety of the food supply.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.
Provide on-site inspections of shelters, when needed, to assess the food preparation techniques and safety of food being served. DPHS Food Inspectors will conduct inspections of shelters in our jurisdiction.	**Deleted**	Identified as preparedness/response. Action status agreed upon by stakeholders at May update meeting.

Instructions: **Please review the New, Ongoing, and Deferred actions that have been compiled as a result of the collaboration at the May 18, 2018 stakeholder meeting. Enter a rating (1-5, with 5 being the most effective and 1 being the least) for each prioritization criteria listed (shown in the blue columns). Click on the column header for a description of the prioritization category. Additionally, please verify you agency's acronym if/when shown and enter Potential Funding sources if known.**

New Hampshire State Multi-Hazard Mitigation Plan 2018 Update
Hazard Mitigation Actions Prioritization Worksheet

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
1	Expand upon current descriptors used for State asset inventory to include data such as location, building material, and hazard vulnerabilities.	**New**	Multi-Agency	All Hazards											
2	Work toward implementing the New Hampshire Coastal Risk and Hazard Commission recommendations related to hazard mitigation.	**New**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding											
3	Increase understanding about flood risks and related impacts at the confluence where freshwater and tidal waters meet in estuarine systems, from wave action, and from changing sediment dynamics	**New**	NHDES - Coastal Program	Coastal Flooding /Inland Flooding											
4	Provide NFIP training and outreach to communities that encourages sound floodplain management practices and promotes flood hazard mitigation activities and available funding mechanisms.	**New**	NH OSI	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones											
5	NH DES Coastal Program will continue to maintain historical tidal gauge data from Fort Point and strive to gain the ability to archive historical data for the Hampton tidal gauge.	**New**	NHDES	Coastal Flooding											
6	Explore potential multi-agency uses of LIDAR data to support mitigation activities, such as holistic watershed flood monitoring.	**New**	NHDES	Coastal Flooding / Inland Flooding / Tropical and Post-Tropical Cyclones											
7	Continue to sustain the stream gauge program and identify funding resources to strategic installation of additional stream gauges.	**New**	NHDES	Inland Flooding											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
8	Maintain NHDES funding and coordinate with other funding sources to replace aging infrastructure. Promote asset management activities at drinking water and wastewater systems.	**New**	NHDES	Aging Infrastructure / Emerging Contaminates											
9	Identify and address sources of emerging contaminants. Where possible, provide alternate water.	**New**	NHDES	Emerging Contaminates											
10	Explore and implement the digitization of records across the State and consider assessment of current location of documentation with respect to hazard vulnerabilities.	**New**	Multi-Agency	All Hazards											
11	Sustain the implementation of the required annual State employee cyber training.	**New**	Multi-Agency	Cyber Event											
12	Maintain Program Administration by State (PAS) status allowing for the continued authority to Formally Approve Local Hazard Mitigation Plans.	**New**	NH HSEM	Natural Hazards											
13	Provide education and outreach for mitigation strategies in reference to pre-event debris management.	**New**	NHDES, NH DOT	Natural Hazards											
14	Provide standardized guidance on temperatures, sea-level rise, and precipitation changes, to local communities for incorporation into planning efforts.	**New**	NHDES	Natural Hazards											
15	Encourage NFIP-participating communities that conduct floodplain management activities exceeding the minimum NFIP requirements to consider joining the Community Rating System (CRS), an NFIP incentive program that provides discounts to flood insurance premiums for some residents and businesses as a reward for the community's activities.	**New**	NH OSI	Inland and Coastal Flooding											
16	Continue implementation and expansion of the NH Alerts program for both the public application and State employee notification.	**New**	NH HSEM	All Hazards											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
17	Organize and train Road Agents, EMDs and "Skywarn" etc. volunteers in affected areas in ice monitoring activities that will enhance the NH-CRREL database.	**Completed and Ongoing**	NH Silver Jackets / CRREL	Inland Flooding / Severe Winter Weather											Silver Jackets Team executed Ice Jam Outreach Project in the fall of 2017. Will continue to provide outreach.
18	Sustain the Emergency Alert System as necessary.	**Ongoing**	NH HSEM	All Hazards											
19	Maintain the tips line for the reporting of homeland security concerns	**Ongoing**	NH IAC	Terrorism/Violence / MCI / Cyber Event											
20	Provide technical assistance through funding and staff support to coastal communities to enhance current and future coastal hazard mitigation planning and activities	**Ongoing**	NHDES - Coastal Program	Coastal Flooding / Inland Flooding											
21	Utilize collaborative partnerships, including the NH Coastal Adaptation Workgroup and the Upper Valley Adaptation Workgroup, to conduct outreach, technical assistance and assessments on current and future flood hazard mitigation.	**Ongoing**	NHDES	Coastal Flooding / Inland Flooding											
22	Update storm surge, sea-level rise, precipitation, and other relevant projections recommended in the Coastal Risk and Hazards Commission 2014 report "Sea-Level Rise, Storm Surges, and Extreme Precipitation in Coastal New Hampshire: Analysis of Paste and Projected Trends" at least every 5 years, pursuant to Chaptered Law 121.	**Ongoing**	NHDES - Coastal Program	Coastal Flooding / Inland Flooding											
23	Evaluate the impacts of saltwater intrusion and changing groundwater table elevations as a result of sea-level rise and implications for water, waste, and asset/infrastructure management.	**Ongoing**	NHDES / NH DOT	Coastal Flooding / Inland Flooding											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
24	Maintain the statewide Reverse 911 system for the dissemination of hazardous situations and emergency events.	**Ongoing**	NH E911	All Hazards											E911 continues to maintain the emergency notification system.
25	The SHMO will provide State agencies, local communities, Regional Planning Commissions, private non-profit, and private entities with applicable hazard mitigation outreach regarding the State's initiatives and available resources.	**Ongoing**	NH HSEM	Natural Hazards											
26	The State will closely support local communities, with assistance from contractors and regional planning commissions, in the creation of single-jurisdiction and multi-jurisdiction hazard mitigation plans.	**Ongoing**	NH HSEM	Natural Hazards											
27	Sustain the New Hampshire Department of Environmental Services and Water Division in the implementation of the State's Drought Management Plan.	**Ongoing**	NHDES	Drought											
28	Sustain the enhancement of the gauging network as recommended by the USGS and NHDES-WD.	**Ongoing**	NHDES	Inland and Coastal Flooding											
29	The SHMO will work with local communities, contractors, and regional planning commissions to develop and maintain lists of public and private facilities considered essential to regional and local interests during/after events within their Local Hazard Mitigation Plans.	**Ongoing**	NH HSEM	All Hazards											
30	NH HSEM will continue to work with the States Interagency Hazard Mitigation Team (IHMT) to prioritize and select projects which are cost beneficial and address the State's mitigation goals and objectives.	**Ongoing**	NH HSEM / IHMT	natural hazards											
31	Incorporate 500 year flood plain threshold for new construction of drinking water and wastewater facilities in accordance with NEIWPCC's TR-16 Guides for the Design of Wastewater Treatment Works and other similar documents (Revised 2011 Edition).	**Ongoing**	NHDES	Coastal Flooding / Inland Flooding											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
32	Promote and educate in the development of increased standards for those facilities that maybe at risk from natural, human-caused, and technological hazards.	**Ongoing**	Multi-Agency	All Hazards											
33	The Dam Bureau will continue to execute dam safety inspections and enforcement programs as needed.	**Ongoing**	NHDES	Inland Flooding / Dam Failure											
34	Sustain NHDOT and UNH - TTC - T2 Program in the development of road design construction, storm water and road drainage standards, including culvert and bridge sizing.	**Ongoing**	NH DOT, UNH	All Hazards											
35	Continue the development of local and regional river corridor stewardship programs such as the Rivers Management and Protection Program.	**Ongoing**	Multi-agency	Inland Flooding											
36	NH DOT to conduct vulnerability assessments on the 24 critical bridges throughout the State.	**Ongoing**	NH DOT	Aging Infrastructure											
37	NH DOT to identify, analyze, and create design solutions for repeated areas of road closures.	**Ongoing**	NH DOT	All Hazards											
38	NH IAC will conduct vulnerability assessments and maintain a database for State critical infrastructure.	**Ongoing**	NH IAC, DHS	All Hazards											
39	NH IAC will educate state and local public safety and health personnel on CIKR asset protection and assistance programs	**Ongoing**	NH IAC	All Hazards											
40	Provide planning and related technical resources to facilitate the enhancement of Disaster Response and Recovery Plans to include Hazard Mitigation initiatives.	**Ongoing**	NH HSEM	All Hazards											State will continue to update State Emergency Operations Plan and Recovery Annex.
41	Sustain the development of public/private partnerships in the planning for post-event recovery to promote a more resilient State.	**Ongoing**	NH HSEM	All Hazards											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
42	HSEM will continue to host the Annual Emergency Preparedness Conference, which includes the promotion and education of mitigation.	**Ongoing**	NH HSEM	All Hazards											
43	Provide generators at selected state-owned fuel locations to provide fuel to emergency vehicles during an extended power outage.	**Ongoing**	NH DOT	All Hazards											
44	NHDOT will continue providing transfer switches on construction of new signals on projects.	**Ongoing**	NH DOT	All Hazards											This action will allow communities to bring in a portable generator (of certain specifications) during a prolonged outage event to power the lights at these intersections. For certain priority intersections as requested by communities, NHDOT will install transfer switches on existing traffic signal systems; again the community is always required to provide the generator during outages.

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
45	Receive and disseminate homeland security information from federal, state and local partners in accordance with annual federal information sharing requirements.	**Ongoing**	NH IAC	Terrorism/ Violence, Cyber, Mass Causality Incident											
46	The State's Historic Preservation Officer (SHPO) and the NH DNCR-DHR will continue to inventory, catalogue and assess the State's important Archeological and Historical properties (including buildings, dams, bridges etc.).	**Ongoing**	NH DNCR-DHR / NH HSEM	All Hazards											
47	NH DNCR-DHR will continue its State Conservation Rescue Archeology Program (SCRAP), which is the recruitment and training field survey teams to expedite historical site reviews in an emergency.	**Ongoing**	NH DNCR-DHR	All Hazards											
48	Fund cost –effective Mitigation Projects through available federal grants and local cost share (HMGP, PDM, FMA).	**Ongoing**	NH HSEM	Natural Hazards											
49	Encourage and assist communities with the mitigation of repetitive loss properties acquisition & demolition, relocation or elevation (funding through HMGP, PDM, FMA).	**Ongoing**	NH HSEM	Coastal Flooding / Inland Flooding											
50	NH HSEM will make the NH State Multi-Hazard Mitigation Plan Update 2018 available online as an interactive PDF through the HSEM Resource Center and other applicable State websites.	**Ongoing**	NH HSEM	All Hazards											
51	NH OSI will provide training and outreach to communities that encourages sound floodplain management practices and promotes flood hazard mitigation activities and available funding mechanisms.	**Ongoing**	NH OSI	Inland and Coastal Flooding											Realized to be redundant, has been removed.
52	Promote funding and resources for land acquisition, conservation planning, land management programs, and land stewardship in areas at risk of loss or degradation due to sea level rise.	**Ongoing**	Multi-agency	Coastal Flooding / Inland Flooding											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
53	Recommend a comprehensive planning and zoning policy such as development setbacks and limits on density and infrastructure in coastal and transitional zones to consider vulnerability to sea level rise and saltwater intrusion.	**Ongoing**	NH CAW / NHDES	Coastal Flooding / Inland Flooding											
54	Encourage communities to adopt floodplain management regulations that exceed the minimum NFIP requirements, incorporating higher standards (e.g. freeboard, setback and compensatory storage requirements) that will improve local flood resilience.	**Ongoing**	NH OSI	Coastal Flooding / Inland Flooding											
55	Promote the installation of regionally and locally significant staff gauges, tidal gauges, and other such monitoring equipment as determined to be necessary by local EMDs, Road Agents, etc.	**Ongoing**	USGS/NH HSEM	Coastal Flooding / Inland Flooding											
56	NH DNCR-DHR will continue to complete and maintain a statewide assessment of deficiencies in survey data (done by town, but phase by county if necessary)	**Ongoing**	NH DNCR-DHR	Natural Hazards											
57	State agencies will continue the collaborative development of information dissemination opportunities via many outreach methods, including but not limited to: broadcast media, social media platforms, ReadyNH.gov, Public Service Announcements (run on closed cable networks and broadcast media), printed materials, direct outreach through NH HSEM's Field Services Section, The Ready Chinook Program for school aged children, and exhibits at conferences and workshops in an effort to educate the State in regards to preparedness, response, recovery and mitigation.	**Ongoing**	Multi-Agency	All Hazards											
58	Sustain the dissemination of emergency information through the statewide 211 system.	**Ongoing**	NH HSEM / Granite United Way	All Hazards											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
59	Disseminate information with respect to the availability of the Hazard Mitigation Assistance (HMA) Programs, including emailed notifications, requests for Letters of Intent (LOIs) to eligible applicants, and by conducting applicant briefings as to the existence and status of funding and related grant funding requirements.	**Ongoing**	NH HSEM	Natural Hazards											
60	Continue to develop and maintain GIS layers as a multi-agency collaborative effort to capture data, including but not limited to: • NH DES: Stream Crossing Initiative geodatabase. • NH DNCR-DHR: Sensitive natural and cultural resources and historical and archeological properties, and incorporation of archeological site data in the new Electronic Mapping and Management Information Tool (EMMIT) and promote use by municipalities, local heritage commissions, historical societies, and preservation professionals. • NH DNCR-DFL: LANDFIRE data layers (used to determine statistical probabilities of wildland fires). • NH DES Coastal Program: Coastal hazards (maximum flooding extent, nuisance flooding extent, etc.), locations of natural and manmade protective systems and barriers (salt marshes, seawalls, etc.), ongoing study locations, and others. Data collected in partnership with NH Fish and Game, UNH Sea Grant, and GRANIT. • NH HSEM: Maintain Hazard Mitigation Assistance (HMA) Program funded project layer.	**Ongoing**	DNCR-DHR	All Hazards											
61	NH DNCR-DHR, including the State's Historic Preservation Officer (SHPO), will continue their efforts to improve the protection of important historical properties against fire, vandalism, and flooding, among other hazards.	**Ongoing**	NH DNCR-DHR	All Hazards											

	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
62	Using materials supplied by National Fire Protection Association (NFPA) and others, the State will utilize and develop public information materials for distribution to appropriate State agencies, regional planning committees and local planning committees. Additionally, the NHSFMO will review and develop (as necessary) Public Service Announcements to alert interested parties to the existence of fire, life safety, and hazardous materials risks.	**Ongoing**	NHFMO	Conflagration, Wildfire, Hazardous Materials											
63	The Department of Natural and Cultural Resources will continue to assist in the development of the Community Wildfire Protection Plans (CWPP) and other plans and authorities to identify cost effective wildland fire hazard mitigation measures in accordance with the State's Forest Fire Protection Plan.	**Ongoing**	NH DNCR, NH HSEM	Wildfire											
64	Maintain video surveillance at select Turnpike Toll Plazas, Welcome Centers, Rest Areas, Park-n-rides, Transit Centers, and other critical assets.	**Ongoing**	NH DOT	All Hazards											
65	Maintain collection and distribution of accurate weather and roadway information through the use of existing Road Weather Information System (RWIS). Enhance existing system through deployment of additional stations.	**Ongoing**	NH DOT	Natural Hazards											
66	Incorporate projected sea-level rise, storm surge, and precipitation as well as associated changes in flood levels, currents, groundwater tables, stormwater runoff, and other related impacts into capital improvement projects, permitting, and other state actions.	**Ongoing**	Multi-Agency	Coastal Flooding / Inland Flooding											

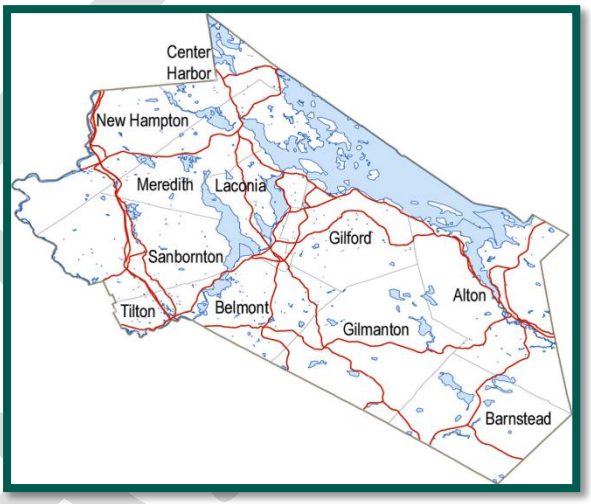
	Action	Status	Responsible Agency/Party	Hazard(s)	Potential Funding	Life Safety	Property Protection	Technical	Political	Legal	Environ-mental	Economic	Social	Admin-istrative	Comments
67	Enhance syndromic surveillance in schools	**Ongoing**	NH DHHS	Infectious Diseases											School surveillance is constantly monitored by NH DHHS Infectious Disease Control. Data is submitted by schools on a volunteer basis and analyzed for base line and trends.
68	Continue to develop and utilize within the Communicable Disease Control Section (CDCS) standard operating procedures for each reportable disease.	**Ongoing**	NH DHHS	Infectious Diseases											
69	Continue to expand the use of NH Electronic Disease Surveillance System (NH EDSS) to all investigating staff members at the local and state level.	**Ongoing**	NH DHHS	Infectious Diseases											

E - County History (Excerpt from 2013 Plan)

The following is an excerpt from the 2013 State Multi-Hazard Mitigation Plan that provides historical information about each of the ten counties in New Hampshire. Population information included here is from the 2010 census, which, at the time this plan was written, was the most recent census to be completed. Updated population information and trends can be found in the Population Changes and Estimations section of the Plan.

Belknap County

Belknap County was established in 1840 from portions of Strafford County. The county was named for Dr. Jeremy Belknap, Dover Congregational Church minister and author of The History of New Hampshire, which chronicled the early history of the state. Belknap is one of two counties in the state without an interstate border; Merrimack is the other. A large part of Lake Winnipesaukee, all of Lake Winnisquam, and many smaller lakes cover nearly one-sixth of the county, which is the largest amount of inland water among New Hampshire's counties. Belknap County contains 400.2 square miles of land area and 68.4 square miles of inland water area. Based on the 2010 Census, the population density is 150.1 persons per square mile. Belknap County includes one city, Laconia, and ten towns.



Carroll County

Carroll County surrounds the north-south midpoint of the state's eastern border. Established in 1840, the county was named for Charles Carroll of Carrollton, Virginia, a signer of the Declaration of Independence. It adjoins Maine along a 53-mile, almost perfectly straight, line. It is the second least populated county, falling after Coos County. About a quarter of the county is within the White Mountain National Forest. A ten-mile long thumb of land encompassing Crawford Notch and Hart's Location juts out between Coos and Grafton Counties. There are no cities located within Carrol County. Carroll County contains 931.1 square miles of land area and 61.4 square miles of inland water area. Based on the 2010 Census population, the population density is 51.4 persons per square mile. Carroll County includes 18 towns and one unincorporated place, Hale's Location.

Cheshire County

Cheshire County, one of the five original counties, occupies the southwest corner of the state. It is separated from Vermont by a 41-mile length of the Connecticut River, and borders Massachusetts along a 27-mile straight line to the south. Established in 1769, the county was named for Cheshire County in England. Cheshire is New Hampshire's median county. It ranks sixth among the ten counties in total area, land area, water area, population, and population density. Cheshire County is the location of Mount Monadnock, one of the most-hiked peaks in the World. Cheshire County contains 707.0 square miles of land area and 22.4 square miles of inland water area. Based on the 2010 Census, the population density is 109.1 persons per square mile. Cheshire County includes one city, Keene, and 22 towns.

Coos County

Coos County covers the top fifth of New Hampshire, sharing a 71-mile straight border with Maine to the east, an 85-mile border with Vermont to the west, and a 58-mile border with Canada to the north. Established in 1803, the county was named after the Indian word 'cowass' or 'kohass,' meaning 'crooked river' because of the bend in the Connecticut River. The White Mountain National Forest and Nash Stream State Forest cover a sizable portion of the county. Coos County contains 1,795.0 square miles of land area and 35.1 square miles of inland water area. Based on the 2010 Census, the population density is 18.4 persons per square mile. Coos County includes one city, Berlin, 19 towns, and 23 unincorporated places, 15 of which are unpopulated. All of those areas are listed on the map located within this page. (not all unincorporated areas are shown).

Grafton County

Grafton County occupies the west central border of the state, halfway between north and south. It is separated from Vermont by an 89-mile stretch of the Connecticut River. Like Coos County, Grafton covers nearly one-fifth of the state. It was one of the five original counties established in 1769, and was comprised of all of the current Grafton and Coos Counties until 1803. The county, like the town, takes its name from Augustus Henry Fitzroy, Duke of Grafton, and an enthusiastic supporter of the American cause prior to the Revolution. The county contains a substantial amount of inland water, most of which is Newfound Lake or part of Squam Lake, and includes half of the White Mountain National Forest. Grafton County contains 1,709.0 square miles of land area and 40.8 square

miles of inland water area. Based on the 2010 Census, the population density is 52.2 persons per square mile. Grafton County includes one city, Lebanon, 38 towns, and one unincorporated place, Livermore.

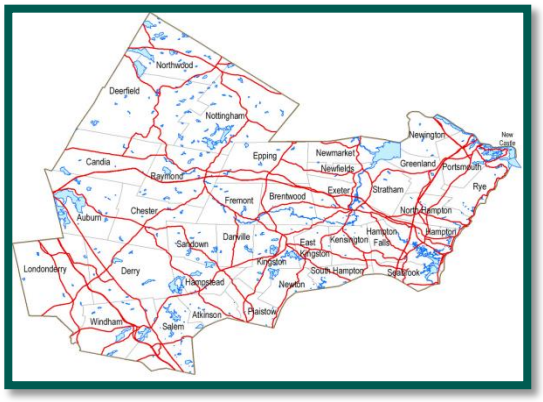
Hillsborough County

Hillsborough County occupies the south central portion of the state along a 36-mile border with Massachusetts. Hillsborough was one of the original five counties, created by the Provincial Act in 1769, authorized by Governor John Wentworth. It was named in honor of Wills Hill, Earl of Hillsborough, and a councilor of King George III. The town of Hillsborough was the birthplace of Franklin Pierce, the only United States president from New Hampshire. The town, first granted in 1735 and incorporated in 1772, was probably named not for the Earl, but for landowner Colonel John Hill. Hillsborough County contains 876.1 square miles of land area and 16.1 square miles of inland water area. Based on the 2010 Census, the population density is 457.4 persons per square mile, highest among the counties. Hillsborough County includes two cities, Manchester and Nashua, and 29 towns.

Merrimack County

Nestled in the south central portion of the state, equidistant from both the Maine and Vermont borders, Merrimack County is one of two counties that has no interstate borders; Belknap is the other. It is the location of Concord, the state capitol, which is tucked into a bend in the Merrimack River. The county takes its name from the Merrimack River, whose name was adapted from an Abenaki Indian word meaning "deep." The county was formed in 1823 from towns in Hillsborough and Rockingham counties. Merrimack County contains 934.1 square miles of land area and 22.3 square miles of inland water area. Based on the 2010 Census, the population density is 156.8 persons per square mile. Merrimack County includes two cities, Concord and Franklin, and 25 towns.

Rockingham County

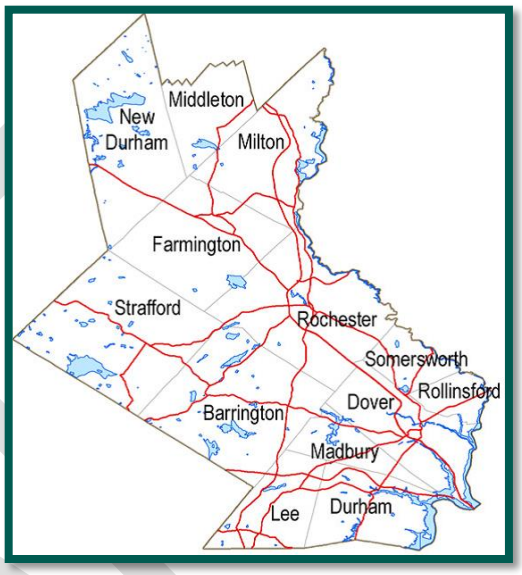


Covering the southeast corner of the state, Rockingham County contains all of the state's 18 miles of Atlantic Ocean coastline, the shortest coastline of any state in the US. The Piscataqua River and Portsmouth Harbor separate the county from Maine on a nine-mile stretch to the northeast, and it shares a 56-mile border to Massachusetts on the southern side. Rockingham was one of the five original counties established in 1769, and at one time covered Concord and all of the current

Merrimack County towns east of the Merrimack River. It was named for Charles Watson-Wentworth Marquis of Rockingham. The seacoast town of Rye was one of the first places to be settled in New Hampshire. Rockingham County contains 694.7 square miles of land area and 100.4 square miles of inland water area. Based on the 2010 Census, the population density is 425.0 persons per square mile. Rockingham County includes one city, Portsmouth, and 36 towns.

Strafford County

Strafford County is located on the eastern border of the state. A 45-mile stretch of the Salmon Falls River, pouring into the Piscataqua River, separates the county from Maine. It is the only county with three cities—Rochester, Dover, and Somersworth. It was one of the five original counties established in 1769, once encompassing all of what is now Belknap County and the portion of what is now Carroll County not in the White Mountain National Forest. The county was named for the Earl of Strafford, a title held by the Wentworth family in England, who were prominent in New Hampshire politics in colonial days. Dover, along with Rye, was one of the first places to be settled in New Hampshire. Strafford County contains 369.0 square miles of land area, the smallest among the counties, and 15.0 square miles of inland water area. Based on the 2010 Census population, the population density is 333.7 persons per square mile. Strafford County includes three cities, and ten towns.



Sullivan County

Sullivan County is located on the western border of the state, south of center. It borders Vermont to the west with a 36-mile stretch of the Connecticut River. Sullivan County came into existence in 1827, made up of communities taken from Cheshire County. The county's name was in honor of General John Sullivan, a Revolutionary War hero and author of New Hampshire's motto: "Live Free or Die." General Sullivan served as a member of the Continental Congress, Adjutant General to George Washington, and Major General of the Northern Army. He was elected "President" of New Hampshire in 1786. The town of Sullivan, in Cheshire County was named for him in 1787. Sullivan County contains 537.3 square miles of land area and 14.7 square miles of inland water area. Based on the 2010 Census, the population density is 81.4 persons per square mile. Sullivan County includes one city, Claremont, and 14 towns.